Government of Saskatchewan

Annual Report 1991-92

Saskatchewan Energy and Mines

93-00079/

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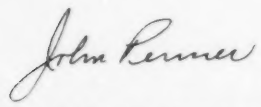
Letter of Transmittal

The Honourable Sylvia Fedoruk
Lieutenant-Governor
Province of Saskatchewan

Dear Madame:

I have the honour to submit herewith the Annual Report of Saskatchewan Energy and Mines for the fiscal year ending March 31, 1992.

Respectfully Submitted,



Honourable John Penner
Minister of Energy and Mines

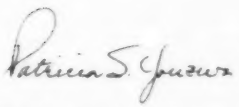
Letter of Transmittal

The Honourable John Penner
Minister of Energy and Mines
Province of Saskatchewan

Dear Sir:

I have the honour to submit for your consideration, the Annual Report of Saskatchewan Energy and Mines for the fiscal year ending March 31, 1992.

Respectfully Submitted,



Patricia S. Youzwa
Deputy Minister
Saskatchewan Energy and Mines

Message from the Deputy Minister

The 1991-92 fiscal year was a challenge for the Department of Energy and Mines. Uncertainty and weak commodity prices in international markets continued to impact the performance of Saskatchewan's energy and mineral resource sectors. Increased pressures to contain expenditures within government saw the budget of the department decline from the previous year and fiscal restraint measures throughout the year resulted in further curtailment of expenditures. The provincial election in October, 1991 resulted in a change of government. As a consequence, a major activity in the last half of the fiscal year was focused on transition and briefing for the new administration.

Within this environment, several significant accomplishments aimed at addressing emerging public policy issues and strengthening the provincial resource sector were achieved. Many initiatives were undertaken to further develop and diversify the sector and address increasing environmental concerns. Some of these initiatives are highlighted below.

Although oil activity levels were low in 1991-92 due to low crude oil prices, interest in horizontal wells continued to flourish in Saskatchewan. In 1991, 146 horizontal wells were drilled compared to 77 in 1990. The department has worked to support and facilitate the application of this technology. It has the potential to reduce production costs and increase recovery rates.

In 1991-92, a new long-term fiscal system was introduced for horizontal wells which recognized the higher risk associated with this technology and at the same time provided for a fair share of revenue for the Crown. Also, legislative and regulatory amendments were made to introduce a new set of rules governing resource production and conservation practices.

In recognition of the growing complexity of issues, particularly involving horizontal wells, the Oil and Gas Conservation Board was reconstituted in 1991-92. The board will deal with disputes referred to it by the minister and provide recommendations for settlement. The board is financed through the Oil and Gas Revolving Fund which is funded equally by the government and industry.

The federal and provincial governments entered into a Memorandum of Understanding on Energy Initiatives in September, 1991. The parties agreed to co-operate to develop and implement initiatives including clean coal technologies, fossil fuel developments, conservation and alternate energy, and nuclear research and technology development. The MOU was intended to identify sustainable economic development initiatives building on the diversity and strength of the province's energy resource sector.

The department, with the assistance of several other departments and agencies, undertook a comprehensive review of uranium mining. Six new uranium mines are proposed for Saskatchewan representing a major expansion to the industry over the next several years. These projects are currently undergoing federal and provincial environmental assessment. The department worked with the Department of Environment and Public Safety to establish terms of reference and a panel for a joint federal-provincial review.

Information and advice was provided regarding the establishment of an energy conservation and development authority to review long-term electrical generation options for Saskatchewan. This authority will also promote research and development in energy conservation and development.

The department also successfully completed the second year of the Canada-Saskatchewan Partnership Agreement on Mineral Development. The purpose of the program is to enhance competitiveness, encourage exploration and diversification, and support research and development in the mineral industry. Significant achievements in 1991-92 included the successful completion of several geological mapping projects near Creighton and Hanson Lake, which provided insights into the mineral potential of the region and the staking of new claims. Also, preliminary studies of diamonds and brines in Saskatchewan were completed and reports were published during the year.

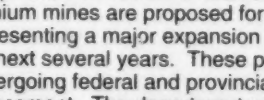
The department participated in the development of a Great Sand Hills Land Use Strategy which removed four sensitive protection areas from natural gas development. Compensation for companies holding leases in these areas was negotiated by the department. Furthermore, in other areas of this unique natural habitat, any new gas development proposal now will be subject to an environmental impact assessment.

The department continued its joint efforts with the Department of Environment and Public Safety to develop a Clean Air Strategy for Saskatchewan to establish priorities and set comprehensive plans to deal with atmospheric environmental issues. Many of these issues, such as global warming, raise questions regarding energy production and use. In 1991-92, a discussion paper entitled "The Clean Air Strategy - A Background Report" was prepared and a workshop for 60 major stakeholder groups was held in February, 1992.

The department also participated in a study by the Coal Association of Canada to examine the feasibility of building an Integrated Coal Gasification Combined Cycle (IGCC) power plant in Canada. This new clean coal technology would virtually eliminate acid gas and particulate emissions and reduce carbon dioxide (CO_2) emissions. The study was completed in 1991-92 and the department worked with SaskPower to assess the opportunity to construct a commercial scale IGCC demonstration project in Saskatchewan.

In conclusion, I would like to thank the staff of Saskatchewan Energy and Mines for their outstanding contribution during 1991-92. The high calibre of work combined with their professionalism and dedication contributed greatly to our success in this challenging year.

Respectfully submitted,



Patricia S. Youzwa
Deputy Minister
Saskatchewan Energy and Mines

Overview of Saskatchewan's Energy and Mineral Resources

Saskatchewan is endowed with a wide array of energy and mineral resources and is ranked fourth in overall mineral and energy production in Canada after Alberta, Ontario and British Columbia. The energy and mineral sector is an important component of the provincial economy and a major source of revenue for the province.

In 1991, total value of mineral and energy sales was $2.8 billion. This represents about 14 per cent of Saskatchewan's Gross Domestic Product. In the 1991-92 fiscal year, the mineral and energy sector paid $331.3 million in revenues to the province representing eight per cent of the provincial revenues. Employment in mines and the oil and gas fields totalled almost 10,000 jobs in 1991. Energy and mineral companies invested almost $450 million in Saskatchewan.

Oil is found along the western edge and the south-eastern corner of the province. Saskatchewan's oil reserves at the beginning of January 1991 were 119.8 million cubic metres. There are currently 375 companies producing oil in the province. Over one-half of Saskatchewan's oil is sold to the United States. Oil is also sold in the province to the NewGrade upgrader and the SaskOil Asphalt Plant, and to Alberta and eastern Canadian refineries.

The gas fields are located along the western edge of the province. Saskatchewan's gas reserves at the beginning of 1991 were 83.9 billion cubic metres. Saskatchewan natural gas is sold in the province directly to consumers and to SaskEnergy, the provincial utility. Over one-half of Saskatchewan's natural gas production is sold to eastern Canadian consumers.

Potash is found in a wide band across central and south-eastern Saskatchewan. Potash reserves are so plentiful in Saskatchewan that production can continue at current rates for hundreds of years. There are currently six potash companies operating mines in the province. Sixty per cent of our potash production is sold in the United States, five per cent in Canada and 35 per cent overseas.

Uranium is found in the Precambrian Shield in the northern part of the province. Uranium reserves are sufficient for more than 50 years at current production rates. There are currently three producing mines with further development underway. Saskatchewan's uranium is sold to produce nuclear energy. Over one-half of the production is sold in the United States with the rest sold in Canada, Europe and the Far East.

Gold and base metals such as copper, zinc and nickel are also found in the Precambrian Shield in the northern part of the province. Even though gold production in Saskatchewan has recently declined and reserves are relatively small, the province is still believed to have exploration potential. Saskatchewan has not been a large producer of base metals and reserves are relatively small.

Coal is found along the U.S. border. Saskatchewan has 7.6 billion tonnes of coal or hundreds of years of production at current rates. There are currently five mines in the province, four near Estevan and one at Coronach, and two producing companies. Eighty-five per cent of Saskatchewan's coal is sold to SaskPower to generate electricity, with the rest sold in Manitoba and Ontario.

Saskatchewan also produces sodium sulphate, bentonite, salt and sand and gravel.

Department Mission and Objectives

Department Mission

The department's mission is to work to achieve full and responsible development of our energy and mineral resources creating jobs and sustaining economic activity in Saskatchewan, and to provide stable revenues to fund government programs and services.

Department Objectives

To promote development of Saskatchewan's energy and mineral resources by:

- reviewing and developing policies, and providing information and recommendations to government related to incentives, markets, investment, taxation, pricing, rate of development, research and development and environmental issues that impact the energy and mineral sectors;
- providing long-term forecasts of production, sales, price, royalty revenue, employment and investment;
- collecting, evaluating, maintaining and providing to industry exploration, development, production and disposition data;
- conducting research into the geology and mineral deposits of the province;
- evaluating and monitoring oil and gas reservoirs for resource assessment and project approval purposes; and
- providing geological services and public information.

To secure a fair share of revenues from Saskatchewan's energy and mineral resources by:

- designing and managing appropriate royalty and tax structures;
- establishing and implementing appropriate rental rates, fees, land sales, mineral rights tax rates;
- auditing and monitoring data used for revenue calculations; and
- implementing and managing a revenue collection system that maximizes collection of revenues owing to the province.

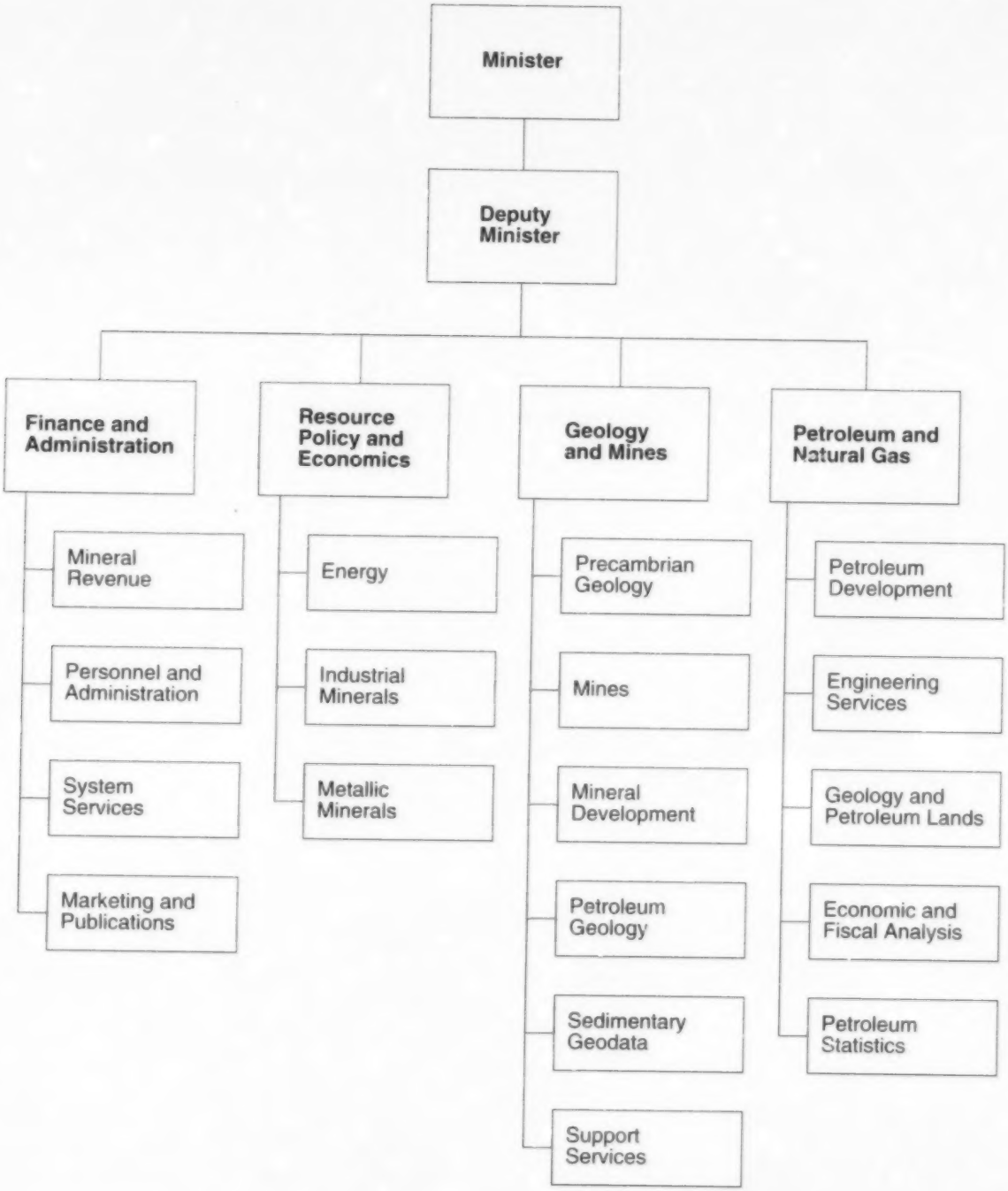
To ensure maximum resource recovery and environmentally responsible resource development by:

- designing and delivering research, development and demonstration funding programs for the fossil fuel and potash sectors;
- establishing and enforcing environmental and safety standards for oil and gas fields and mineral exploration and development;
- establishing, monitoring and enforcing oil and gas conservation standards and regulations; and
- issuing geophysical and well licences for oil and gas.

To ensure that the development of Crown minerals maximizes economic benefits to the province through the disposition and administration of Crown mineral rights.

To promote the efficient use of energy by encouraging conservation, alternative energy sources and development of energy efficient technologies.

Organization Chart



Resource Policy and Economics Division

Overview of Division

The mandate of the division is to identify, undertake research and analysis and provide information and policy recommendations to government on emerging issues related to mineral and energy development. The division is responsible for designing and maintaining royalty and tax revenue programs for coal, industrial and metallic mineral resources. The division also serves as the department liaison with the federal and other provincial governments on issues of mutual concern in the mineral and energy sectors and is responsible for negotiating agreements with other jurisdictions that may be required with respect to these issues.

The division has three branches: Energy with separate Policy and Energy Management Sections, Industrial Minerals and Metallic Minerals.

The division is funded through the Consolidated Fund and the Revolving Fund.

Resource Development Program

Policy Development

Within this program, the division monitors and analyzes market trends, industry performance, and policy and regulatory initiatives in other jurisdictions and provides information and policy recommendations on issues that impact on the energy and mineral sectors. Reports and recommendations are provided to the minister and the government with respect to market conditions, pricing trends, industry investment, research and development expenditures, and socio-economic and environmental implications of industry activity.

The division maintains contact and consults with the industry on the policy recommendations which are developed to respond to these issues. The division also provides liaison with other divisions, other departments and Crown agencies and other governments on resource policy and development issues.

The mandate for this program comes from the following acts and their respective regulations:

- *The Mineral Resources Act* which provides authority with respect to the exploration, development, management and conservation of mineral resources.
- *The Oil and Gas Conservation Act* which provides the authority to implement natural gas policy.

The goals for the 1991-92 fiscal year included:

- providing timely and accurate reports on and forecasts of industry activity;
- monitoring the effectiveness of existing policies and recommending new policies to sustain or enhance energy and mineral investment and development; and
- assisting the government in resolving specific resource development issues such as uranium and nuclear energy development, impact of environmental concerns and regulatory changes on resource development and administration of sand and gravel rights.

During the fiscal year:

- Monthly reports on natural gas, potash and uranium were produced to provide regular updates on market events, pricing changes, industry activities and regulatory and policy developments in other jurisdictions which impact on these commodities.
- Forecasts of production, sales, price, revenue, employment and investment were prepared for coal, natural gas, potash, uranium and sodium sulphate. These forecasts assist the government in budget planning, economic forecasting and planning and negotiating federal-provincial equalization.
- A comprehensive analysis was completed on uranium mining including safety, markets, socio-economic benefits, investment, infrastructure, environmental impact and royalty structures. The Departments of Environment and Public Safety, Community Services, Human Resources, Labour and Employment, Justice and Education assisted in the analysis.
- In consultation with the Departments of Parks and Renewable Resources and Rural Development, Crown administration of sand and gravel rights were reviewed and a decision was made to transfer administration from the Department of Energy and Mines. The sand and gravel rights will be administered along with the other surface rights under the respective jurisdictions of the Departments of Parks and Renewable Resources and Rural Development.
- Division staff represented the department on the Intergovernmental Working Group (IGWG) on the mineral industry and co-chaired a Subcommittee on Native Participation in Mining. Northern communities, aboriginal groups and mining companies were surveyed to assess aboriginal participation in mining. The results of the survey were published in December 1991, in "It Can Be Done", a report on native participation in the mining industry.
- The potential impact of aboriginal land claims on resource and energy development was analyzed and a report provided to other departments and agencies involved in treaty land entitlement negotiations.
- Policy options and possible financial instruments which could be used to assure reclamation of mine sites in Saskatchewan were reviewed.
- Division staff prepared the mineral and energy sections of the State-of-the-Environment Report.
- A review of natural gas permit policy resulted in a decision to discontinue departmental authorization of the consumption of Saskatchewan gas by non-Saskatchewan consumers. This decision, together

with other selected efficiency measures, allowed the elimination of one position and facilitated the processing of the 615 new and amended permits. As of March 31, 1992, there were 496 active permits (an increase of 139 or 39 per cent over last year) authorizing the flow of 479 billion cubic feet of natural gas (an increase of 116 billion cubic feet or 32 per cent over last year).

- The annual natural gas supply security determination indicated that reserves totalling 430 billion cubic feet were available within Saskatchewan for contracting. The determination, together with SaskEnergy's obligation to maintain reserves under contract equalling 15 years of current consumption, assures Saskatchewan gas consumers that their future gas requirements can be met.

The total cost of the policy development activity was $538,000 and involved seven full-time and one half-time staff. Of the total cost, 84 per cent was covered by the Consolidated Fund and 16 per cent by the Revolving Fund.

For further information, contact Dan McFadyen, Assistant Deputy Minister, Resource Policy and Economics, at 787-2523.

Resource Revenue Program

Coal, Industrial and Metallic Minerals

Within this program, the division monitors and manages royalty and tax systems for coal and industrial and metallic mineral resources. The objective of the royalty and tax systems is to ensure a fair economic return to the province from resource development, while maintaining a healthy investment climate to encourage industry to explore and develop these resources. In the 1991-92 fiscal year, these royalty and tax systems collected over $120 million.

The royalty and tax systems are reviewed in regard to changing market and pricing trends, changing costs of production and capital employed, and impacts of regulatory and policy changes in other jurisdictions. Analysis and recommendations on changes to royalty systems in response to these conditions are provided to the government for consideration. Consultation with industry is a key consideration in developing changes to royalty and taxation systems.

The mandate for the program comes from the following acts and their respective regulations:

- *The Mineral Taxation Act* which provides the authority to tax freehold minerals in the province; and
- *The Crown Minerals Act* which provides the authority to collect royalties on Crown minerals in the province.

The goals for the 1991-92 fiscal year included:

- monitoring and maintaining the royalty and tax systems and resolving any issues arising through their administration;
- developing and maintaining computer models to assist in the analysis of the royalty and tax systems;
- reviewing sales contracts to ensure fair market value is received for Saskatchewan uranium and natural gas;
- providing encouragement for potash research and development and market development through incentives in the tax system; and
- preparing revenue forecasts.

During the fiscal year:

- Amendments to *The Potash Production Tax Regulations* were developed, reviewed with industry and implemented.
- Numerous issues arising from the administration of the royalty and tax systems were identified, reviewed and resolved.
- Industry programs for potash market development and research and development were reviewed and approved. The industry spent over five million dollars on market development and research and development for potash. Emphasis was placed on improving our competitive position and on environmental concerns, particularly the disposal of salt waste.
- Short and long-term revenue forecasts were prepared on a regular basis.

The total cost of this program was $538,000 and involved seven full-time and one half-time staff.

For further information, contact Dan McFadyen, Assistant Deputy Minister, Resource Policy and Economics, at 787-2523.

Energy Management Program

Energy Production and Use

Within this program, the division develops policies and programs to encourage the sustainable development and utilization of energy resources in Saskatchewan. Energy management policies and programs are developed to promote the efficient use of energy by Saskatchewan consumers, to improve the competitiveness of businesses through improved energy management practices and to investigate the environmental impact of energy utilization. Policies and programs are also developed to encourage the enhanced production or value-added processing of energy resources through technological innovation.

The division monitors developments in other jurisdictions, both nationally and internationally, that may impact on sustainable production or use of our energy resources and participates in a number of intergovernmental initiatives examining various issues related to sustainable development.

The mandate for this program comes from the following acts and their respective regulations:

- *The Energy and Mines Act* which describes the minister's authority and responsibility with respect to energy management and provides authority to enter into agreements with other governments; and
- *The Mineral Resources Act* which provides authority for conservation of mineral resources.

The goals for the 1991-92 year included:

- evaluating the need for and preparing a plan for development of a Comprehensive Energy Strategy for Saskatchewan;
- initiating the development of a Clean Air Strategy for Saskatchewan;
- promoting energy conservation with Saskatchewan consumers;
- promoting opportunities that encourage enhanced recovery of our conventional energy sources;
- completing a three year co-operative research program with Japan's New Energy and Industrial Technology Development Organization;
- monitoring and analyzing the impact on the energy sector of national and international initiatives to reduce air emissions; and
- acting as the liaison for the department on federal-provincial committees addressing air quality issues.

During the fiscal year:

- A proposal to develop a Comprehensive Energy Strategy was presented to and approved by the government.
- Information and advice was provided to the government regarding the establishment of the Saskatchewan Energy Conservation and Development Authority.
- A background paper on a Clean Air Strategy for Saskatchewan was prepared and a Clean Air Strategy Workshop involving over 60 groups was held in Saskatoon in co-operation with Saskatchewan Environment and Public Safety.
- The Pro-Trucker program to encourage more efficient use of energy in the trucking industry was launched in co-operation with the Saskatchewan Trucking Association and the federal government.
- The toll-free Energy Conservation Telephone Line to provide energy conservation information to Saskatchewan consumers was promoted. A total of 370 information requests were handled.
- An inventory of greenhouse gas emissions was developed and a study on ways to reduce emissions of greenhouse gases was completed.
- The co-operative research program on heavy oil upgrading with Japan's New Energy and Industrial Technology Development Organization was completed and a mechanism for continuous information exchange on further co-operative ventures was established.
- A Memorandum of Understanding (MOU) on energy was successfully negotiated with the federal government which will facilitate the study of mutually beneficial energy conservation and energy development opportunities.
- Officials represented the department on the Intergovernmental Secretariat to the Action Committee on Low Sulphur Western Canadian Coal to Ontario. Through the Action Committee, the department participated in several studies on transportation and taxation of coal and a study by the Coal Association of Canada on the feasibility of constructing an integrated gasification combined cycle project (new clean coal technology) in Canada.

Total cost of the energy production and use program was $496,000 and involved five staff.

For further information, contact Malcolm Wilson, Assistant Director, Energy Management Section, at 787-2618.

Geology and Mines Division

Overview of Division

The mandate of the division is to promote exploration and development opportunities in the province for the petroleum and mineral industries through the collection and provision of geoscientific data and by administering the disposition of Crown minerals other than petroleum, natural gas, helium and oil shale.

The geoscientific data base consists of:

- geological, geophysical and geochemical maps and reports;
- mineral deposit files;
- mine plans and production data;
- well files for petroleum, natural gas, coal and industrial minerals; and
- collections of drill cores from exploration for petroleum and natural gas, coal, potash, industrial minerals and metallic minerals.

The data base is of fundamental value to the petroleum and mineral sectors of the province in designing investment strategies and planning exploration programs. It is also of value to the federal and provincial governments for assessing mineral potential and for forecasting commodity supply and mineral production. There is a growing demand for geoscientific and mineral development information for engineering, land use, and environmental purposes.

The Mineral Resources Act provides authority to conduct surveys of minerals, collect exploration and production information from mines and wells, investigate and test minerals to determine their value, and establish training programs in exploration and mining. Authority to dispose of, and withdraw, Crown minerals is covered by *The Crown Minerals Act* and in regulations pertaining to the Act.

The division has five branches: Precambrian Geology, Sedimentary Geodata, Petroleum Geology, Mineral Development and Mines. In addition, there is a Support Services Section which carries out cartographic drafting, editorial work and desktop publishing.

The division is funded through the Consolidated Fund and the Revolving Fund totalling $2,200,600 for salaries for 50 staff and $408,700 for other expenses. In addition, $897,000 were provided under the Mineral Development Agreement through the Economic Diversification and Investment Fund and $158,000 were provided from the Public Service Commission's Student Summer Employment Fund.

Resource Development Programs - Mineral Development Agreement

The Canada-Saskatchewan Partnership Agreement on Mineral Development, 1990-1995, is a five year $10 million program equally cost-shared and delivered by Saskatchewan Energy and Mines and the Geological Survey of Canada. A joint committee designs and approves programs and monitors expenditures. The main objectives of the program are to:

- strengthen and enhance competitiveness of the mineral industry in Saskatchewan;
- encourage exploration and diversification; and
- support research and development to increase productivity and efficiency of mining and minerals processing.

The provincial component of the Mineral Development Agreement (MDA) supports six geoscience programs: Precambrian bedrock mapping, metallic minerals deposit studies, diamond studies, industrial minerals studies, geophysical studies and development of data bases and a Geographic Information System (GIS).

Major goals for the year were for successful implementation of the second year of the MDA by completing all projects on time and within budget, and to provide preliminary reports and maps to industry at the Open House meeting in November. These goals were met.

Precambrian Bedrock Mapping Program

The purpose of the Precambrian bedrock mapping program is to expand information on the geological history and mineral potential of the northern part of the province. Field studies are carried out primarily to provide information to the mineral exploration industry, and to assess and promote mineral potential in unexplored areas of northern Saskatchewan.

Field studies involve mapping and data gathering by staff during the summer in remote areas of the Precambrian Shield. The rest of the year is spent analyzing the data and preparing geological maps and reports.

During the fiscal year:

- As part of a multi-year program, the Flin Flon-Bigstone Lake area (Figure 1) was studied for deposits of copper, zinc, nickel, gold and other minerals. Detailed mapping was completed east of Amisk Lake (Figure 1A) with additional mapping of the Northern Lights region (Figure 1B). Results are expected to focus future exploration for copper and copper-zinc.
- Field work was conducted in the Attitti Lake area (Figure 1C) in response to renewed economic interest and new potential for copper-zinc. This has resulted in increased copper-zinc potential and prompted new staking.

Figure 1 - Precambrian bedrock mapping projects under the Canada-Saskatchewan Partnership Agreement on Mineral Development 1990-95. Letters show approximate location of main field projects described in text. The names on the map refer to geological domains in the Precambrian Shield of northern Saskatchewan.

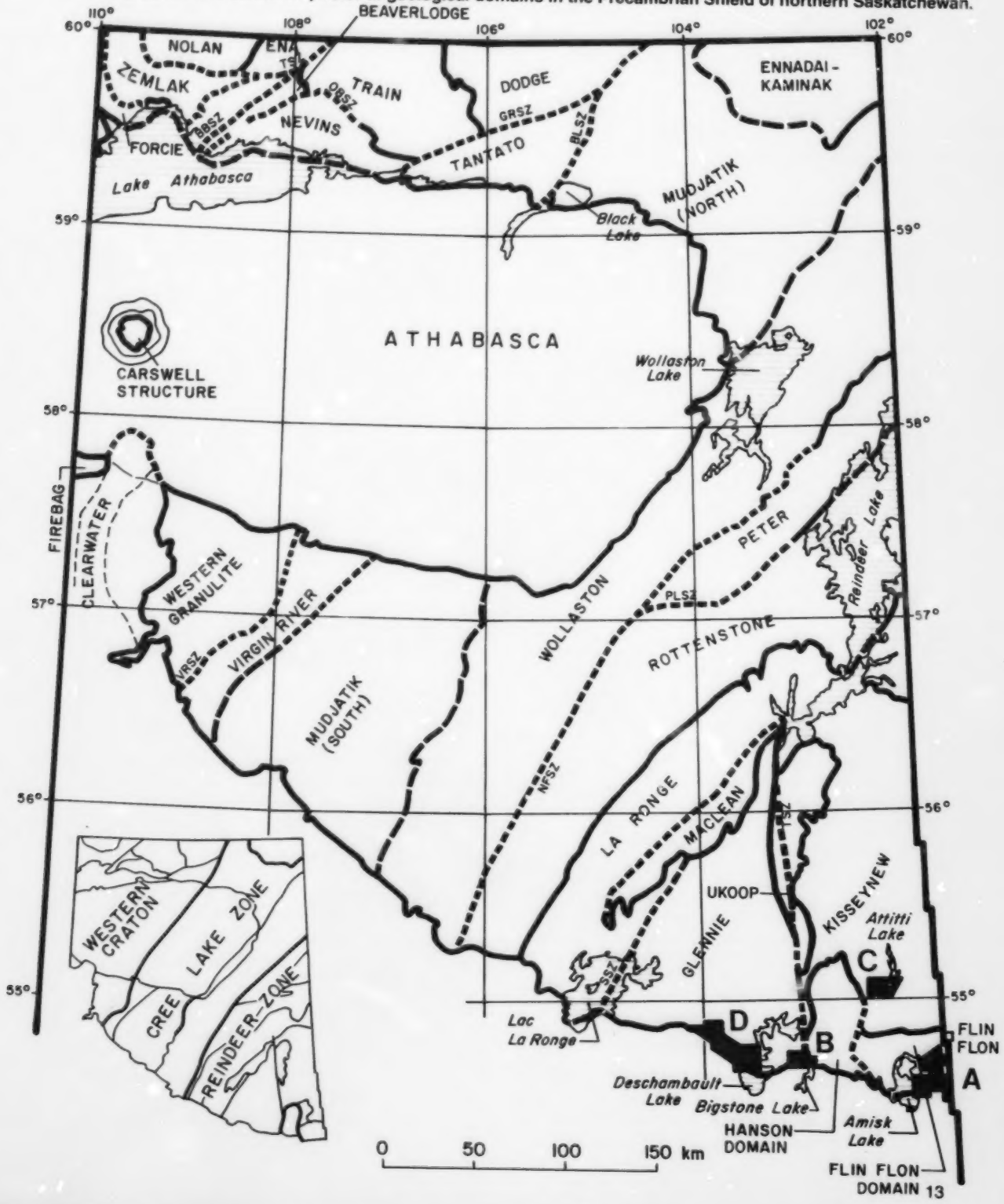
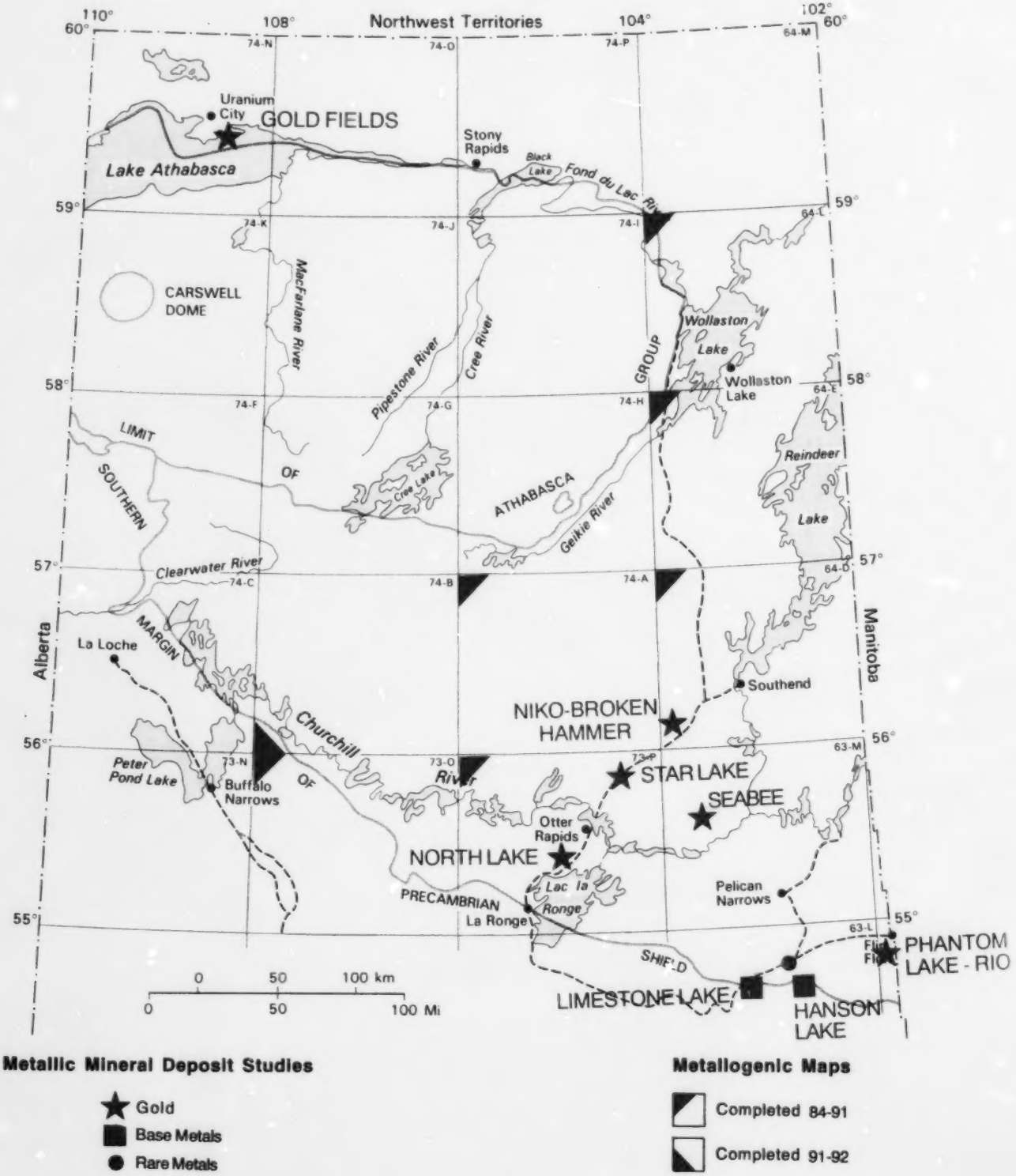


Figure 2

LOCATION MAP



Metallic Mineral Deposit Studies

- Gold
- Base Metals
- Rare Metals

Metallogenic Maps

- Completed 84-91
- Completed 91-92

- Geological information was updated in the Deschambault Lake area (Figure 1D) where there are several indications of gold deposits.
- Further age dating established age ranges of analyzed samples and helped determine geological relationships, particularly in the Flin Flon area, leading to a better understanding of the mineral potential.

Maps and preliminary reports have been published for all of the areas mapped. Final reports, which will include the work of several years, are in preparation.

Significant advances were made in understanding and documenting the regional geological relationships in all of the study areas. This new information has resulted in new staking of mineral claims.

For 1991-92, operational funds of $411,000 were budgeted under the Canada-Saskatchewan Partnership Agreement on Mineral Development for geological mapping projects and supporting studies in the Flin Flon-Bigstone Lake, Attitti Lake and Deschambault Lake areas. This involved contract and staff project geologists. In addition, $96,000 were budgeted for university students employed as geological assistants under the Public Service Commission Student Summer Employment Program.

Most of the bedrock mapping projects reported are in the middle stages of completion. The intent is to continue work in these general areas until 1994-95 when the current Mineral Development Agreement with the federal government expires. No mapping is planned in the Attitti Lake area in 1992-93, but office work will be carried out on that project.

Metallic Mineral Deposit Studies

The Mineral Development Branch provides ongoing documentation of the province's metallic mineral deposits and their geological setting (Figure 2). This information is used to help the search for new mineral resources, which is becoming more difficult with time.

The following five gold projects were carried out in the La Ronge Gold Belt to assist exploration, particularly in the Star Lake area where three of Saskatchewan's now exhausted new gold mines have been located:

- structural investigations of gold deposits and their host rocks in the Star Lake area;
- geochemical investigations of gold deposits in the Star Lake area and at North Lake;
- mapping of the Niko and Broken Hammer gold deposits north of Star Lake;
- geological investigation of the Seabee Mine gold deposit; and
- geological investigation of barren quartz veins in areas of gold-quartz vein mineralization.

Two base metal projects were undertaken in the Hanson Lake - Limestone Lake area west of Flin Flon.

This region has been the site of two recent significant copper-zinc discoveries. The projects were:

- geochemistry of volcanic rocks in the Hanson Lake area; and
- mapping of volcanic rocks north of Limestone Lake to evaluate base metal potential.

Rare metals and rare-earth elements are receiving increasing attention from mineral explorationists because of their increasing application in high-tech industries. The mapping and sampling of beryl-bearing pegmatites in the Hanson Lake area to determine distribution and rare-metal concentration was underway as part of the evaluation of the economic potential of such resources in northern Saskatchewan.

Two contracts supported mineral deposit investigations by providing specialized analytical services as follows:

- stable and radiogenic isotope determinations and electron microprobe analyses; and
- uranium-lead zircon geochronology of the Wollaston Domain.

Projects were contracted to geoscientists at the Universities of Saskatchewan, Regina and Waterloo and the Saskatchewan Research Council or were undertaken by Mineral Development Branch staff in conjunction with other duties. The seven contracted projects resulted in expenditures of $139,100. The three in-house projects involved three branch geologists and employed two summer students. Operational cost was $20,400.

Kimberlite (Diamond) Studies

Geological investigation of Saskatchewan's diamond potential continued during the fiscal year. The study included sampling and analytical work to develop guidelines for diamond exploration in Saskatchewan.

Work during the fiscal year concentrated largely on mineral sampling from 110 locations throughout the southern and east-central parts of the sedimentary basin, sample processing and analyses and completion of a report - "Diamonds and Precious Gems of the Phanerozoic Basin, Saskatchewan: Preliminary Investigations".

Project costs for the fiscal year were about $38,000.

Industrial Minerals Studies

Industrial minerals studies include technical and economic assessments. Information is provided in technical papers and reports to encourage and promote industrial development in the province.

Several projects were in progress during the fiscal year including:

- testing of samples of high-grade silica sand deposits in the Hanson Lake area;
- studying brines for calcium and magnesium chloride, bromine, boron and iodine;
- studying industrial clay resources to provide further

information for industry to evaluate and, ultimately, develop the resource;

- developing digital geological models of lignite coalfields in southern Saskatchewan in conjuction with the Geological Survey of Canada to provide economic and technical characteristics of coal seams and host rocks; and
- promoting building stone resources of Saskatchewan through the production, distribution and display of a photographic portfolio of prepared stone samples and display of polished stone slabs.

An open-file report, "Sub-Duperow Formation Brines in Southern Saskatchewan", was published to provide background information for industry to promote further brine studies and the eventual establishment of a brine-based chemical industry.

The brine chemistry data base consisting of 14,000 analyses was digitized with the assistance of the Geological Survey of Canada and was made available for purchase. In addition, a long-term program of brine sampling and analytical work was established with the co-operation of the petroleum industry.

A report on the Estevan coalfield was nearing completion at fiscal year end.

The building stone portfolio was made available to the Tokyo's Stone Exposition, the 47th annual convention of the Marble Institute of America in Quebec City, a group of Japanese business representatives meeting in Edmonton and for local architectural and northern development interests. Further interest from these groups on building stone resources in Saskatchewan is anticipated.

The projects were conducted by one permanent senior geologist, one full-time contract geologist, three part-time contract geologists and one student assistant. The aggregate project cost was just over $143,000, not including the cost of publishing two technical reports.

Geophysical Studies

Mineral and petroleum exploration programs use geophysical data to define potential exploration targets. Two geophysical studies were initiated under MDA to stimulate exploration:

- extension of aeromagnetic coverage into southern Saskatchewan; and
- gravity data compilation with the assistance of the U.S. Defense Mapping Agency which is interested in modelling the variations in satellite orbits due to changes in the earth's gravity field.

The 1991 phase of the southern aeromagnetic survey included over 47,000 kilometres of flightline coverage over an area of about 24,500 km^2 in the Hudson Bay - Melfort area.

Under the gravity survey program, a total of 38,868 station records, representing about 20 per cent of the total area surveyed, were digitized. Gravity maps generated from the data will be of significant value to the petroleum and mineral exploration sectors in the province.

One contract geologist and one student assistant worked part-time on gravity data compilation under the supervision of a senior permanent geologist. The department's participation in the aeromagnetic survey project with industry and the Geological Survey of Canada was partly on a cost-sharing basis and partly in a technical advisory capacity. Total expenditures on geophysical studies were $35,000.

Data Base Development and Geographical Information System (GIS)

Regional geoscience data bases provide a reference of geological materials and data and are used in-house and by the private and public sectors. They are maintained and continually upgraded by the Precambrian Geology Branch. The geoscience data bases include rock and mineral sample collections as well as computer data files.

A new Precambrian geochronology chart was published to accompany the Precambrian geochronological data base which, together with the Saskatchewan Precambrian bibliography, was updated in digital form.

An example of a coloured computer-drawn geological map, based on 1991 field work, was displayed at Saskatchewan Energy and Mines' Open House in November, 1991 and at the Geological Survey of Canada's Open Forum in January, 1992. Geology and Mines also initiated the development of a Geographical Information System (GIS) for geoscience data files.

For further information on the Mineral Development Agreement, contact Bob Macdonald, Provincial Co-chairman, at 787-2568.

Resource Development Programs-Industry Exploration and Development Data

The major objective of the program is to collect, maintain and enhance geoscientific data on Saskatchewan's energy and mineral resources to facilitate industry's development of Saskatchewan's resources.

Mineral Assessment Work Submissions

The mineral industry submits exploration and development information as required under *The Mineral Disposition Regulations, 1986*. The technical work and financial credits claimed in the submissions are audited.

The technical information is put into the Saskatchewan mineral assessment file which is an important data base for mineral exploration and land use planning. Mineral occurrence data is kept in the Saskatchewan mineral deposits index and further processed into maps. The maps provide an appraisal of mineral resource potential.

For the fiscal year:

- A total of 1,127 submissions were received for claimed expenditures of $69.54 million, up 31 per cent from 1990-91. These are broken down by

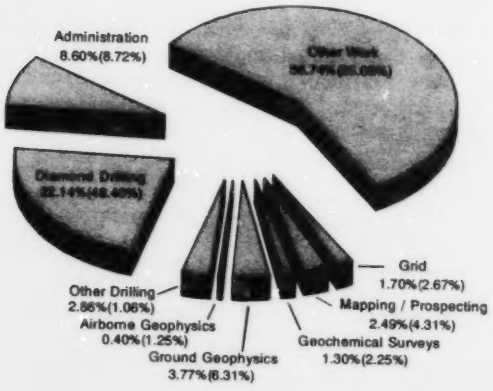
specific exploration activity in Figure 3 and by region in Figure 4.

- A total of 146 new assessment files were incorporated into the Saskatchewan mineral assessment file. Forty-one visitors were received and 124 requests for information handled. An assessment catalogue was published during the year.
- 158 records were added to the Saskatchewan mineral deposits index which had a total of 2,566 records as of March 31, 1992. There were 22 requests for this information.
- The 1:250,000 scale metallogenic map series established in 1984-85 received ongoing attention. These maps provide details of location, metal association, development status and type of mineralization, as well as reference to information on the presence of minerals. One new sheet (Mudjatik 74B) was completed and was awaiting publication at year end (Figure 2).

The assessment work unit had three professional staff and one full-time and one casual part-time (50 per cent) clerical staff. Two summer students were also employed. Operational cost was about $22,400.

For further information, contact Dr. T.I.I. Sibbald, Director, Mineral Development Branch at 787-2576.

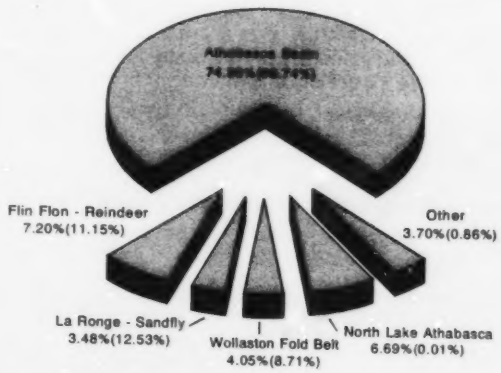
Figure 3 - 1991-92 Assessment Credits By Activity



1991-92 assessment credits by activity. Total credits amount to $69,541,327 up 30.55% from 53,267,334 reported in 1990-91. The large increase in 'other work' reflects test mine development work reported at Cigar Lake. (1990-91 figures in brackets)

Figure 4 - 1991-92 Assessment Credits By Region

(1990-91 figures in brackets)



Industrial Minerals

Industrial minerals include a wide variety of non-metallic minerals useful for their physical and chemical properties in a broad range of industries and industrial processes. Some of the more important industrial minerals in Saskatchewan are:

- potash and sodium sulphate;
- construction materials such as building stone, limestone, aggregate and certain clays;
- industrial clays such as bentonite, kaolin and ceramic clays;
- precious and semi-precious gems such as diamonds, rubies and ammolite;
- coal, peat and leonardite; and
- other material including silica sand, pumicite and refractory minerals.

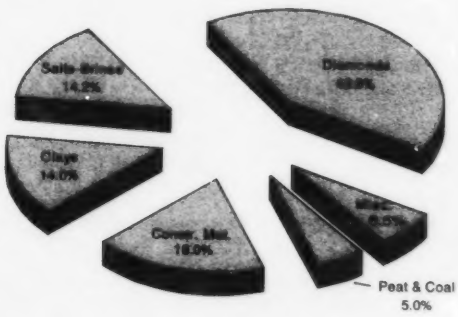
Technical information is received from companies exploring for industrial minerals and coal under *The Quarrying Regulations, 1957* and *The Coal Disposition Regulations*. The data are evaluated to ensure regulatory requirements are met and recorded in the industrial minerals data base which serves the needs of industry, government and the public. The data base is also an important source of information for industrial minerals studies conducted under the Mineral Development Agreement (MDA).

During the fiscal year, about 200 inquiries were received. Figure 5 illustrates the distribution of inquiries by commodity and commodity group.

Work on industrial minerals was carried out by the Industrial Minerals Section. The section had two full-time geologists. Salaries were about $120,000. Other expenses for equipment, travelling expenses and general support were about $48,000.

For further information, contact Paul Guliov, Director, Sedimentary Geodata Branch at 787-2583.

Figure 5 - Distribution of Industrial Mineral Inquiries



Well Records and Geophysical Data

This program maintains a central repository of information on nearly 50,000 wells drilled under *The Oil and Gas Conservation Regulations*. Preliminary and final plans, monthly and flowing shot hole reports, and geophysical maps submitted by industry under *The Sedimentary Basin Geophysical Exploration Regulations* are also processed. The program provides geophysical data for quarterly sales of Crown petroleum and natural gas rights.

In the fiscal year:

- Computerization of the subsurface formation water chemistry and shot hole files was completed.
- Work continued on producing inventories of the seismic structure and shot point location maps.
- Over 10,000 data submissions were received and added to the system.
- 26,000 files were provided to the oil and gas industry.
- Over 1,000 new files were set up and approximately 1,000 maps reproduced for the industry.

Catalogues are now available for the seismic velocity surveys, structure test hole and flowing shot hole files, gravity and magnetic maps and most of the seismic map inventory. Customized computer searches of the well information system, the brine file and the geophysical data file are also made available on magnetic tape, paper, fiche and diskettes. During the fiscal year, 156 magnetic tapes were sold and many searches were provided on the well information system.

Revenue generated from the sale of geophysical data for 1991-92 was $65,000.

These records were maintained in the Sedimentary Geodata Branch by one geologist and two full-time and one part-time (90 per cent) staff. Total budget for the year was $129,800 for salaries and $8,300 for other expenses and was wholly funded by the Revolving Fund.

For further information, contact Bob Troyer, Sedimentary Geodata Branch at 787-2562.

Petroleum Geology

This program extracts geological information submitted for newly drilled wells under *The Oil and Gas Conservation Regulations* and adds the information into the department's computerized well information system. The data are used to promote the geological and economic potential of petroleum areas and formations.

In the fiscal year:

- Stratigraphic information was processed from 1,002 newly drilled wells and added to the well information system.
- The stratigraphy of several hundred older wells was reviewed and used to upgrade the well information system.
- Two regional studies continued -- the geology of the Medicine Hat Sand (Cretaceous) in south-western Saskatchewan and the geology of the Interlake Group (Silurian) in Saskatchewan.

The program was carried out by the Petroleum Geology Section which had four full-time geologists and shared one full-time and one part-time clerk typist. One part-time geologist worked from October to March. Salary for those staff amounted to $257,800. Other expenses, for scientific equipment, contract studies, and general administration amounted to approximately $19,000. The program is entirely funded by the Revolving Fund.

For further information, contact Dr. Doug Paterson, Director, Petroleum Geology Branch, at 787-2625.

Core Storage Facilities

Subsurface Geological Laboratory - 201 Dewdney Ave. E., Regina

The subsurface geological laboratory stores geological materials submitted under *The Oil and Gas Conservation Regulations*. Cores and samples of drill

cuttings are stored. The laboratory ensures that companies submit cores and samples as required under the regulations, treats and stores the cores and samples for future use, and retrieves cores and samples as requested by the industry.

In the 1991-92 fiscal year:

- New cores were received from 267 wells totalling 5,391 boxes of core. This brings the total number of boxes in storage to 294,854.
- New drill cutting samples were processed from 267 wells for a yearly total of 22,912 vials, bringing the total number of vials in storage to 2,087,993.

Companies made 233 visits to the laboratory to conduct geological examinations. Cores examined on premises came from 2,953 wells for a total of 45,835 boxes. Samples examined on premises came from 143 wells for a total of 9,324 vials.

Income from examination charges totalled $46,700.

Samples from 24,411 vials from 261 wells were shipped to Energy, Mines and Resources Canada in Calgary under a long-term agreement for storage and federal analysis.

The laboratory had four full-time lab-workers and shared one full-time and one part-time clerk typist. Two summer students were also employed. Staff salaries amounted to $142,400. Expenses for warehouse upkeep and supplies amounted to approximately $49,000. All expenditures were funded by the Revolving Fund.

For further information, contact Dr. Doug Paterson, Director, Petroleum Geology Branch, at 787-2625.

Precambrian Geological Laboratory, La Ronge

The La Ronge laboratory houses both the office of the resident geologists and the mineralized core collection. The collection has 19,041 metres of concentrated cores and 55,585 metres of complete cores primarily from mineral deposits of uranium, gold and base metals (copper, nickel, zinc, lead) in northern Saskatchewan. The laboratory provides a valuable data base for mineral explorers and geological research workers.

In the 1991-92 fiscal year:

- 2,135 metres from northern mineral deposits were added to the collection.
- 512 metres of sedimentary cores were collected for a total of 32,813 metres (housed at the subsurface geological laboratory in Regina).

Seventy-five persons examined cores from the collection or visited the La Ronge facility.

The collection was administered part-time by the resident geologists and by a summer student Operational cost was $11,800.

For further information, contact Dr. A.J. Gracie, Resident Geologist, at 425-4498.

Mine Data and Mineral Statistics

This program monitors mining activity, collects production data and maintains historical records, including mine plans. It also provides input to the Environmental Assessment Review Panel for all mining projects.

Highlights of the mining activity monitored in the 1991-92 fiscal year include:

- 30 mining operations produced potash, uranium, coal, gold, base metals, sodium sulphate, and salt. In addition, 105 quarry operations produced bentonite, clay and sand and gravel.
- The Jolu and Jasper Gold mines ceased production in the last quarter of 1991.
- The Rabbit Lake Mill resumed uranium production after being shut down for more than two years.
- The Seabee Gold Mine commenced production with its first gold pour in November, 1991.
- The Shand Coal Mine, which will provide coal for the Shand Power Generation Station, started overburden stripping in the last quarter of 1991.
- Two potash wells at the Kalium Chemicals operation were abandoned.
- Two sodium sulphate operations, the Alsask and Cabri plants, ceased production in May, 1991.
- Exploration expenditures for 1991 are estimated at $23 million. This is a drop of approximately eight per cent from last year.
- Industry expenditures on uranium exploration totalled $9.7 million; followed by base metals at $5.6 million; gold at $5.0 million; and diamonds and other industrial minerals at $2.7 million.
- A total of 55 mineral deposits was explored. Of these, 21 were base metals, 18 gold, seven uranium, four were some combination of nickel, copper and platinum, four diamond and one industrial minerals.

Additional information on producing and potential mines was acquired through the following reviews on environmental submissions referred to the department for comments during the fiscal year:

- satellite mine of International Minerals and Chemicals Corporation;
- ash storage site for the Shand Power Generation Station which is to use coal supplied by the Shand Coal Mine;
- potassium sulphate plant of Millar Western Industries Ltd.;
- Midwest Joint Uranium Venture of Denison Mines Ltd.;
- McClean Lake Uranium Project of Minatco Ltd.;
- amendment of the Ministerial Approval for Shand Coal Mine Project;

- amendment of the Ministerial Approval for Poplar River Mine Relocation Project; and
- Cigar Lake Uranium and the MacArthur River Uranium Projects of Cameco.

During the fiscal year, 538 copies of the 10 reports produced for mineral statistics users in the industry were distributed and 52 requests from government agencies were handled.

The Mines and Mineral Statistics Section was staffed by a mining engineer and one support staff and incurred costs of about $85,000 for salaries and $3,000 for operations.

For further information, contact Phil Reeves, Director, Mines Branch, at 787-2584.

Resource Development Programs-Geological Services and Public Education

The main objective of the geological services and public education activity is to facilitate and enhance industry's development of Saskatchewan's resources by providing up-to-date information related to Saskatchewan's mineral and energy resources through publications, reports, maps and open house meetings.

Publications, Drafting and Cartography

Publications

Geoscientific reports and maps are edited, formatted and produced by the Support Services Section.

In the fiscal year:

- Three miscellaneous reports, two open files and other miscellaneous material were produced with one miscellaneous report reprinted. This represents over 550 pages of text, 37 monochrome maps and one coloured map.
- In addition, three final reports and one open file are in various stages of production.

Most reports and maps are sold to mineral and petroleum companies and the general public through the Marketing and Publications Branch.

Printing and reprographics costs were $49,100. An additional $27,000 were provided for report production from MDA funding. Thirty-six per cent of the program was funded by the Revolving Fund.

A list of the 1991-92 publications by the Geology and Mines Division is provided in the Appendix.

Drafting and Cartography

Cartographic and drafting services maintain and provide maps.

The cartographic section consists of two working units, Survey Drafting and General Drafting.

The Survey Drafting Unit prepares thematic monochrome and colour geological maps and text figures. These include metallogenic maps at 1:250,000 scale, outcrop geology, bedrock geology and contoured maps at various scales, stratigraphic cross-sections, and small size maps and figures for inclusion in reports and externally published scientific papers.

During the fiscal year:

- 38 maps were produced.
- Numerous text figures for articles in scientific journals, slides and graphics for conference presentations and displays, and other promotional material for the department were produced.
- Display material was prepared for three major technical conferences.

The General Drafting Unit maintains and updates 355 mineral disposition claim maps, 55 petroleum well location maps (at 1:100,000 scale), 418 petroleum pool boundary maps, and potash and coal lease maps.

During the fiscal year:

- Maps and figures were produced for the quarterly petroleum land sale packages and the 1990 Reservoir Annual.
- The petroleum and natural gas permit map, the coloured petroleum development map of Saskatchewan, numerous text figures, slides and graphics for the department were produced.

Most of the petroleum-related maps are produced by computer. Plans are to computerize all maps handled by the unit in the next few years.

The two drafting units had six cartographers at a cost of $238,900. Supplies and general operational expenses for the two sections were $10,000. Thirty-six per cent of the expenditures were funded by the Revolving Fund.

For further information, contact Charlie Harper, Supervisor, Support Services Section, at 787-2578.

Open House Meeting

The annual "Open House Meeting", organized by the Geology and Mines Division was held in 1991 in Saskatoon. Projects of the geoscience agencies active in Saskatchewan were presented to the mining and mineral exploration industry. Participating with the Saskatchewan Geological Survey were the Geological Survey of Canada, the Saskatchewan Research Council and the Universities of Saskatchewan and Regina.

For 1991, there were 302 participants, an increase in attendance over 1990. This is in contrast to the general decline in mineral industry activity. Operational cost was $11,400.

Public Information and Education

The public information and education program responds to specific requests for information on Saskatchewan's mineral resources and mineral industry, produces educational materials and articles for trade publications to promote knowledge of the province's mineral resources and potential and participates in prospector training.

Activities during the 1991-92 fiscal year, which were funded in part under the Mineral Development Agreement, included:

- Rock kits were assembled for distribution to Saskatchewan schools.
- A slide library was developed illustrating Saskatchewan's geology and mineral resources.
- A Saskatchewan resources display was developed for the annual Prospectors and Developers Convention.
- A prospectors school was held in Creighton with instruction by department geologists and local consultants. The school, organized and funded jointly with Northlands College and SIAST Woodlands Campus, graduated 12 students.

The unit was staffed by one geologist part-time, assisted by other department professional staff and casual student employees as required by the projects. Operational cost was $28,900.

For further information, contact Mr. D. MacDougall, Mineral Development Branch at 787-2579.

Resident Geologists' Offices

The resident geologists in La Ronge and Creighton monitor the mineral exploration industry in northern Saskatchewan and provide up-to-date information on exploration and mining activities and opportunities.

During the fiscal year, the two resident geologists were headquartered in La Ronge. The La Ronge office maintains files of current mineral claims, topographic maps, airphotos, geological maps and reports, and assessment work submissions. The Creighton office has current claim maps. Throughout the year, one of the resident geologists from La Ronge was available for consultation in Creighton.

In the 1991-92 fiscal year, an estimated 1,300 visitors were received at the resident geologists' offices, representing an 11 per cent increase over 1990-91.

The resident geologists' offices were staffed by two geologists, one full-time clerk and two part-time clerical staff. Operational cost was $78,000.

For further information, contact Dr. A.J. Gracie, Resident Geologist, at 425-4498.

Crown Mineral Rights

Disposition and Administration

The major objective of the Crown minerals program is to maximize economic benefits to the province through the disposition and administration of Crown mineral rights.

The Mines Branch is responsible for the disposition, development and conservation of all Crown minerals with the exception of petroleum, natural gas, helium and oil shale.

The Mining Lands Section administers and disposes of Crown minerals under the following regulations:

- *The Mineral Disposition Regulations, 1986* for uranium, base and precious metals, other minerals;
- *The Quarrying Regulations, 1957* for sand, gravel, clay, bentonite and other quarriable substances;
- *Alkali Mining Regulations* for sodium sulphate;
- *The Coal Mining Regulations, 1988* for coal; and
- *The Subsurface Mineral Regulations, 1960* for potash and salt.

Activities are centered in Regina, with field offices in La Ronge and Creighton.

During the fiscal year, 274 new claims were staked covering 188,916 hectares. The total number of claims in good standing on March 31, 1992 was 2,577 covering a total of 1.8 million hectares. This represents a 52 per cent decrease in staking activity compared to the previous fiscal year, reflecting the general decline in exploration.

The following permits and leases were issued during the year:

	Issued During 1991/92		Total in Good Standing March 31, 1992	
	Permits	Hectares	Permits	Hectares
Mineral	4	106,537	5	155,037
Quarrying	5	1,149	6	4,476
Alkali	1	Little Manitou	6	Little Manitou
Coal	5	384	5	384
Subsurface	0	0	3	42,694

	Issued During 1991/92		Total in Good Standing March 31, 1992	
	Leases	Hectares	Leases	Hectares
Mineral	2	944	206	434,057
Quarrying	82	5,587	1,114	25,974
Alkali	0	0	31	12,014
Coal	3	10	852	133,644
Subsurface	0	0	10	214,472

Revenues generated during fiscal year included:

- Annual mineral lease rentals of $17,500 were collected from producing properties. Other metallic revenues of $170,900 were collected as recording fees for permits, claims and leases, registration of assignments, amalgamation of lands fees and search abstracts.
- Application fees in the amount of $4,400 for quarrying permits and leases were received. Revenues of $55,500 were collected through permit and lease annual rentals.

- $18,000 were collected as annual rentals for sodium sulphate leases.
- $676,500 in coal revenue were collected from lease and permit recording fees and annual rentals.
- Annual potash lease and permit rental payments amounted to $437,800.

The disposition of Crown mineral rights was administered by the Mining Lands Section which was staffed by an administrator and four full-time and one half-time support staff. One staff person in the La Ronge field office provided local service. Costs incurred by the Mining Lands Section included salaries of $150,000 and $6,000 in general operations.

For further information, contact Phil Reeves, Director, Mines Branch, at 787-2584.

Future Plans of the Division

Over the next three fiscal years the main focus of the division's efforts will be the successful completion of all projects under MDA funding, in particular:

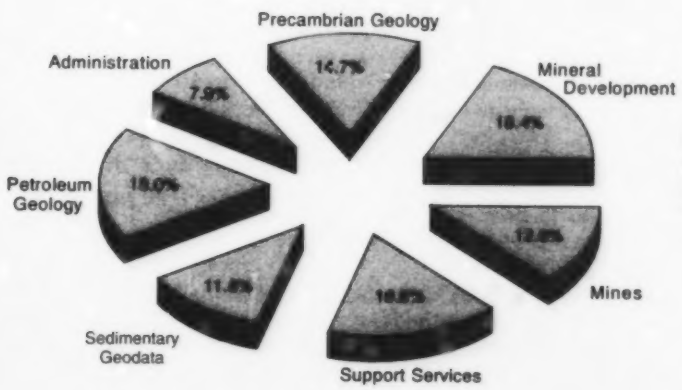
- completion of detailed geological mapping in the Flin Flon (Creighton) - Hanson Lake area leading to a better understanding of gold and base-metal deposits;
- completion of gold and rare-metal studies in the Precambrian;
- further clarification of potential diamond locations through geological studies, regional aeromagnetic surveys and gravity compilations; and
- completion of projects related to silica sand, subsurface brines, clays and building stone.

Another major thrust of the division will be further computerization of the data files related to mineral assessment records, mineral dispositions and mineral deposits. During the current year, computer stations were established for all staff in the Mines Branch and Mineral Development Branch and the first phase of computerizing the mineral disposition system and mineral inventory is essentially complete. Phase two of the project is underway and involves converting the graphical or map component of the files into a computer format.

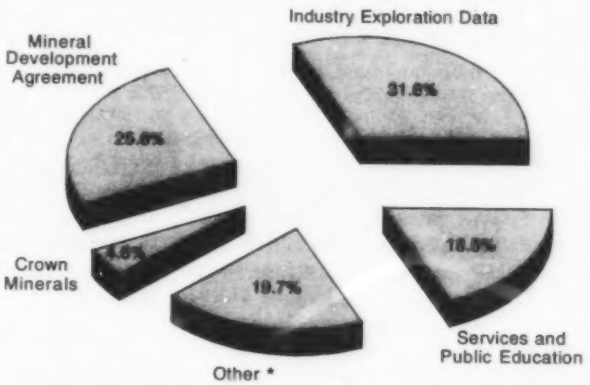
Figure 6 provides a breakdown of expenditures in the Geology and Mines Division by program, organizational unit and Mineral Development Agreement programs.

Figure 6 - Budget Allocation for Geology and Mines

(a) Organizational Unit Basis

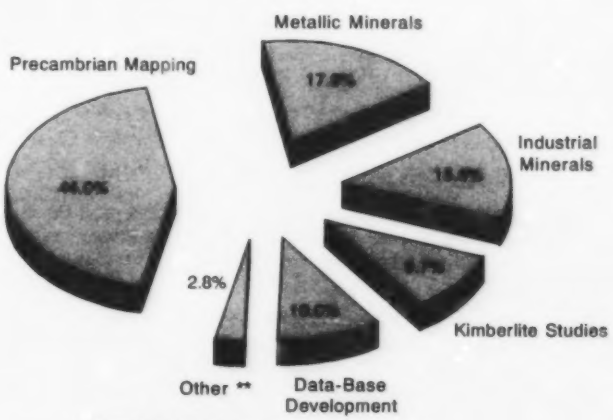


(b) Program Basis



* Costs of permanent staff and services not allocated to program areas.

(c) MDA Projects



** Public information, Prospectors instruction

Petroleum and Natural Gas Division

Overview of Division

The Petroleum and Natural Gas Division has major responsibilities in all areas related to provincial jurisdiction over oil and gas resources. The responsibility includes the disposition and management of Crown oil and gas rights, well licensing and monitoring of field activities, oil and gas conservation including the determination of reserves and producibility estimates, maintenance of production and disposition statistics, and royalty and tax legislation.

The division administers resource development, regulatory and revenue programs as well as the disposition of Crown oil and gas rights.

The programs are carried out by the Petroleum Development Branch, Engineering Services Branch, Geology and Petroleum Lands Branch, Economic and Fiscal Analysis Branch and Petroleum Statistics Branch.

The division is funded through the Consolidated Fund and the Revolving Fund.

Resource Development Programs

Evaluation of Oil and Gas Reservoirs for Resource Assessment and Project Approval Purposes

This program evaluates and assesses oil and gas reservoirs, wells and projects to determine reserves for the purposes of encouraging and facilitating resource development. It also ensures that exploration, development and production by the oil and gas industry follow good conservation, environmental and engineering standards. Reservoirs and wells are also assessed when evaluating industry proposals for horizontal drilling, waterfloods, enhanced recovery, waste water disposal wells, off-target wells, commingling, unitization and pipelines.

The mandate for this program comes from *The Oil and Gas Conservation Act*, *The Crown Minerals Act*, *The Pipe Lines Act* and their respective regulations. This legislation provides the rules under which the oil and gas industry must operate.

Goals for the fiscal year included:

- review and publication of the oil and gas reserves for 1990, by the end of the fiscal year; and
- prompt assessment of industry applications to ensure consistency with good engineering and conservation standards and to ensure that investments are not delayed.

During the fiscal year:

- 1990 reserves were reviewed and published by February, 1992.
- Approximately 500 applications for various projects such as horizontal drilling, waterfloods, enhanced recovery, waste water disposal wells, off-target wells, commingling, unitization and pipelines were reviewed.

The 1990 reserves showed an increase in oil reserves of 12.7 million cubic metres and gas reserves of 10.6 billion cubic metres. At the end of 1990, there were remaining oil reserves of 119.8 million cubic metres and gas reserves of 83.9 billion cubic metres. Estimates for 1991 as shown in Figures 7 and 8 show a modest decrease for both oil and gas.

Figure 7 - Remaining Oil Reserves

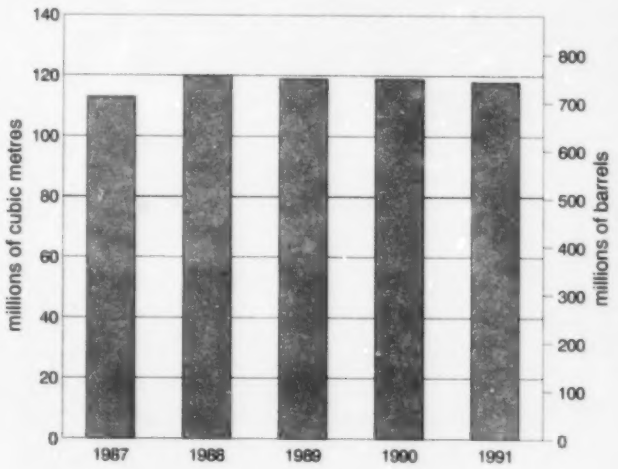
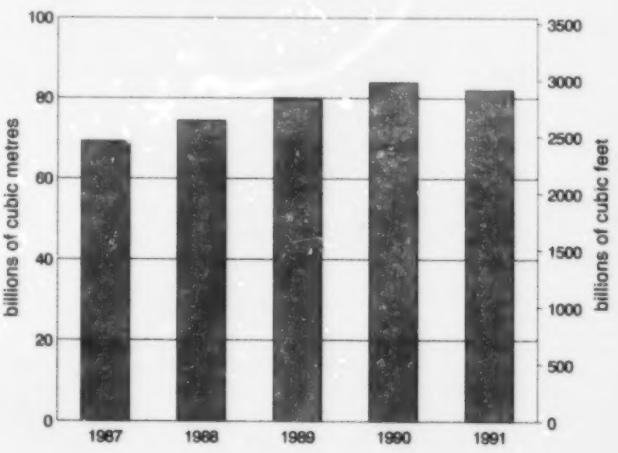


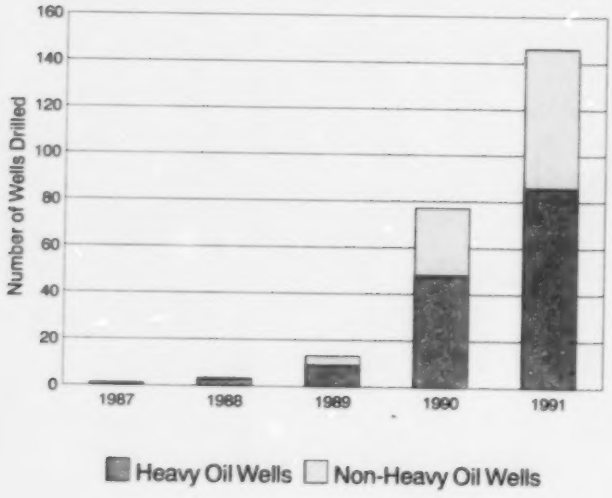
Figure 8 - Remaining Gas Reserves



The reserves data is used extensively by the government in making policy decisions on energy supply and demand and is used in the natural gas security of supply determination. This data is also used by the oil and gas industry in making investment decisions.

As shown in Figure 9, the approval of industry applications resulted in the drilling of 146 horizontal wells in 1991, worth $100 million in investment. Production from horizontal wells increased to 4,200 cubic metres per day or 12 per cent of the total provincial production by the end of 1991.

Figure 9 - Saskatchewan Horizontal Wells Drilled



The 19 applications for waterfloods and enhanced oil recovery projects resulted in significant investments in new facilities with great potential for increases in oil production. The 65 waste water disposal well application approvals allowed for more efficient and economical operation of oil facilities in an environmentally responsible manner. Forty-nine pipeline construction permits were issued providing for new investments and more efficient transportation of oil and natural gas. Fees are charged for pipeline permit applications which resulted in revenues of $14,000.

The Engineering Services Branch was responsible for this program. Approximately $375,000, or 60 per cent of the staff and budget, were allocated to this program. The branch consisted of 10 engineering positions, two technicians and one clerk typist. Salaries accounted for 96 per cent of the expenditures. One hundred per cent of the expenditures were covered by the Revolving Fund.

For further information, contact Myron Sereda, Director, Engineering Services Branch, at 787-2318.

Forecast Production, Revenue and Economic Activity Related to the Oil Industry in Saskatchewan

This program evaluates the impact of short and long-term world price movements, provincial royalty and tax situations, federal income tax provisions and changes in technology related to the oil industry in Saskatchewan. Changes in technical and economic conditions are analyzed to project the impact on drilling activity, production, revenue, employment and investment.

This program is required for internal government economic and budget planning purposes, for internal analysis of royalty and tax regimes within the Economic and Fiscal Analysis Branch and for inquiries from energy boards, energy commissions, pipeline companies and urban and rural municipalities.

The goal of the program is to keep abreast of all changes affecting the oil industry in Saskatchewan and provide accurate forecasts or trends in a timely manner.

During the fiscal year, a number of forecasts were prepared related to production, revenue, employment and investment by the oil and gas industry for internal government planning purposes and federal equalization purposes. The fluctuation in oil prices during the year continued to impact on existing field operations and future investment plans.

The program activities involved three permanent professionals on a part-time basis within the Economic and Fiscal Analysis Branch at a cost of approximately $73,000. Fifth-three per cent of the program was funded by the Revolving Fund. In addition, computer system costs were about $31,000.

For further information, contact Dale Fletcher, Director, Economic and Fiscal Analysis Branch, at 787-2605.

Resource Revenue Programs

Fiscal Systems for Crude Oil and Natural Gas

This program ensures appropriate crude oil and natural gas royalty and tax structures and incentives are in place. The annual objectives of the program are to ensure the province receives a fair share of crude oil and natural gas revenues from producing companies, to assure maximum economic recovery of crude oil and natural gas from established reservoirs and to maintain reasonable levels of exploration and development activity in the province.

The royalty and tax structures and incentives are reviewed as technology and economic conditions change. Consultation with industry is a key component of periodic reviews. Consultation ensures the department is fully aware of the impact of any change being considered and industry is kept informed of the options being reviewed.

When structures or incentives are changed or developed, regulations are amended and circulars and directives are prepared and distributed for the industry.

The Petroleum and Natural Gas Regulations, 1969 provide authority to levy a royalty on Crown oil and natural gas production. *The Freehold Oil and Gas Production Tax Regulations, 1983* provide authority to levy a production tax on non-Crown oil and natural gas production.

During the fiscal year:

- Following completion of a review by a joint industry-department task force, a new royalty and tax regime was implemented for horizontal wells drilled in Saskatchewan after March 31, 1991. The increased interest in horizontal drilling resulted in 146 horizontal wells drilled in 1991 compared to 77 in 1990.
- Factors determining the crude oil royalty and tax rates were adjusted in 11 of the 12 months because crude oil prices continued to fluctuate as world oil supply and demand imbalances continued to exist. This ensured that the province continued to receive fair returns from oil production. The factors determined for October, 1991 resulted in the royalty curves shown in Figure 10.
- Various options were reviewed to enhance government revenues without jeopardizing exploration and development activity.

A total of 1,086 oil and gas wells were drilled in 1991 compared to 1,305 wells in the previous year. Approximately one-third of the successful wells in 1991 received a royalty or tax holiday for a specified period of time. In total, the royalty and tax structures and incentives for oil and gas production generated $240 million for the fiscal year.

The program activities were undertaken by a staff of five professionals within the Economic and Fiscal Analysis Branch. The program operated at a cost of approximately $280,000, with 42 per cent financed by the Revolving Fund. In addition, computer system costs were about $53,600.

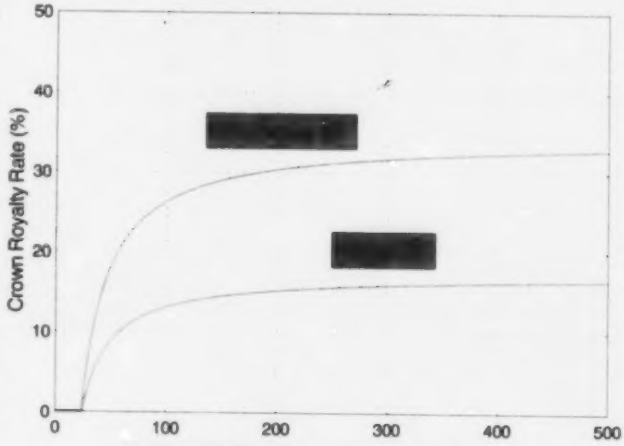
For the 1992-93 fiscal year, oil and gas royalty and tax structures will be reviewed to ensure that they are appropriate for current market conditions. This will be done with full industry consultation.

For further information, contact Dale Fletcher, Director, Economic and Fiscal Analysis Branch, at 787-2605.

Oil and Gas Wells Drilled in 1991

Royalty/ Tax Category	Drilled	Successful	Abandoned
Oil:			
EOR	13	13	0
Horizontal	146	144	2
New Oil:			
no incentive	9	8	1
1-2 year holiday	404	324	80
3 year holiday	41	16	25
5 year holiday	12	3	9
Total Oil	625	508	117
Gas:			
New Gas (no incentives)	461	437	24
Provincial Total	1,086	945	141

Figure 10 - October, 1991 Conventional Crude Oil Royalty Curves for New Developments



Monitor Oil and Gas Royalty and Tax Reporting

This program monitors production and price data reported by operators of oil and gas wells in the province. Monitoring the reported information ensures the proper royalty and tax revenues have been collected from oil and gas production in the province.

For 1991-92, the goals were to examine, in more detail, reported natural gas prices beginning in 1989 and to enhance oil price monitoring functions.

During the fiscal year:

- A wide range of charges and fees deducted from natural gas prices were examined from 1989 onwards.
- Oil prices from certain sales arrangements were examined from 1990 onwards.

Monitoring of natural gas prices resulted in additional revenue of approximately $250,000 for the fiscal year. Monitoring of oil prices resulted in new policies being developed to handle specific crude oil selling arrangements to ensure appropriate revenues to the province.

The program activities were undertaken by one permanent staff member on a part-time basis and one contract employee within the Economic and Fiscal Analysis Branch. The program cost about $64,000. Other costs associated with computer systems within the System Services Branch of the department were also incurred.

Resource Regulatory Programs

Environmental and Safety Standards for Petroleum and Natural Gas Development

The program establishes guidelines for, and monitors activities of, drilling, production, and abandonment of wells by the oil and gas industry. Standards are established for casing requirements, mud handling techniques, spills and clean-up, safe distances, injection well design, and well abandonment. Ongoing monitoring of industry activity ensures that operations are being conducted in accordance with established guidelines and that environmental impacts are negligible.

Program clients are primarily oil and gas companies, geophysical contractors and surface owners whose lands are affected by oil and gas activities.

The Sedimentary Basin Geophysical Exploration Regulations, 1985 pursuant to *The Mineral Resources Act, 1985* establish operating procedures for geophysical activities. *The Oil and Gas Conservation Act* and regulations under the Act govern industry activity as it pertains to drilling, production and well abandonment.

Goals for the fiscal year were to:

- monitor drilling, producing and well abandonment activities to ensure regulation compliance;
- ensure that all oil and salt water spills are properly contained and cleaned up;
- report on the details of all drilling and well completion operations;
- assist surface owners in resolving problems related to oil and gas industry activities; and
- assist in establishing guidelines which would allow for gas development in the Great Sand Hills, while maintaining representative areas in their natural state.

During the fiscal year:

- A comprehensive Great Sand Hills Land Use Strategy was developed in conjunction with the Departments of Environment and Public Safety, Rural Development and Parks and Renewable Resources.
- Field staff conducted in excess of 35,000 well, battery and rig site inspections, monitored clean-up of 464 oil and salt water spills, and assisted in resolving 31 landowner related problems.
- Staff inspected drilling rigs and reported pertinent information on the province's 1,132 wells drilled. As well, workover programs were also reported.
- 1,526 water injection and disposal facilities were inspected to ensure proper water handling and well integrity.

These activities ensured that industry complied with regulations governing their operations so as to minimize environmental impacts. Through the reporting process, up-to-date well information is obtained which is used by the industry as well as for internal government purposes.

The program activities were the responsibility of the Petroleum Development Branch and were undertaken by 14 field officers and four part-time clerical staff under the direction of the branch head. Field offices were situated in Lloydminster, Kindersley, Swift Current and Estevan.

Salary, travel costs and other incidental costs for this work unit were approximately $905,000. One hundred per cent of the expenditures were financed by the Revolving Fund.

For further information, contact Jerry Gossard, Director, Petroleum Development Branch, at 787-2593.

Oil and Gas Conservation Standards and Regulations

This program establishes, monitors and enforces sound oil and gas conservation standards to ensure responsible development of the province's oil and gas.

The mandate for this program comes from *The Oil and Gas Conservation Act, The Crown Minerals Act, The Pipe Lines Act* and respective regulations under the Acts. This legislation provides the rules under which the oil and gas industry must operate.

Major goals for the year included:

- amending *The Oil and Gas Conservation Act* and regulations to accommodate horizontal wells and provide for the establishment of the Revolving Fund and the Oil and Gas Conservation Board;
- developing and implementing *The Oil and Gas Revolving Fund Regulations* to establish the funding and expenditures of the fund;
- setting up the Oil and Gas Conservation Board; and
- reviewing *The Pipe Lines Act* to ensure the legislation adequately addresses government and industry concerns.

Other goals were to:

- keep the pool boundaries and well spacing orders current;
- complete the revisions to the computerized oil production monitoring system;
- keep the establishment of production limitations up-to-date;
- monitor oil and gas wells to ensure production limitations are not exceeded; and
- revise production limitations to include horizontal wells.

During the fiscal year:

- Upon completion of an industry-province task force report on the regulatory framework for horizontal wells, *The Oil and Gas Conservation Act* was amended along with the required regulations and order. As a result, a clear and consistent set of rules for horizontal drilling and production was developed for the industry. In response, 93 horizontal well were drilled in the last seven months of the fiscal year.

- *The Oil and Gas Revolving Fund Regulations* establishing funding and expenditures of the Revolving Fund were approved by Cabinet and implemented by the Fall of 1991.
- The Oil and Gas Conservation Board was appointed in September, 1991 and held its first hearing in March, 1992, related to a waterflood project in the Workman area.
- *The Pipe Lines Act* was reviewed, but amendments were deferred pending further study.
- The ongoing activities of establishing pool boundaries and well spacing orders were carried out with 19 new pools established, 28 revisions and 46 new or revised spacing orders. The revisions to the computerized oil production monitoring system were nearly completed with a few additions still outstanding.

The Engineering Services Branch was responsible for this program. Approximately $250,000, or 40 per cent of the budget and staff, were allocated to this program. Staff consisted of 10 engineers, two technicians and one clerk typist. One hundred per cent of the expenditures were covered by the Revolving Fund.

For further information, contact Myron Sereda, Director, Engineering Services Branch, at 787-2318.

Geophysical and Well Licences

This program reviews applications and issues licences to explore, drill, operate and produce oil, gas and related service wells. Applications are reviewed to ensure compliance with regulations. Geophysical contractors, crews and blasters are licensed to ensure certain operating standards are met and to maintain a current record of companies conducting geophysical work in the province. By licensing the drilling and operation of oil, gas and service wells, the department ensures that Crown mineral rights have been properly acquired, that wells are properly located, and that drilling and casing requirements are met according to regulations.

The Sedimentary Basin Geophysical Exploration Regulations, 1985 pursuant to *The Mineral Resources Act, 1985* provide the authority for geophysical licences. *The Oil and Gas Conservation Act* and regulations govern the licensing of oil, gas and service wells.

The basic goal of the program was to review and process licence applications in a timely and accurate fashion to facilitate the exploration and development of Saskatchewan's oil and gas resources. The work unit attempts to process licence applications within 24 hours of receipt.

During the fiscal year, 1,157 well licences, 73 geophysical contractor licences, 110 crew certificates and 252 blaster permits were issued. In addition, responses were provided to numerous telephone and written inquiries. A total of 4,813 well transfers and 2,107 name changes were also registered by the unit.

As a result of the well licensing, there were a total of 1,132 wells drilled, resulting in 1.12 million metres drilled. (See Figures 11 and 12.)

Figure 11 - Wells Drilled by Area

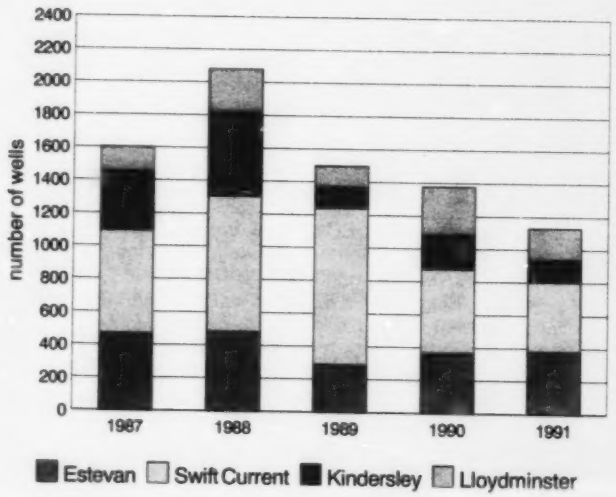
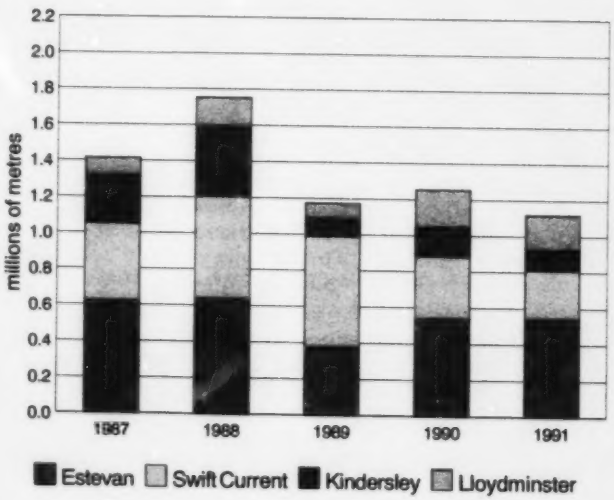


Figure 12 - Metres Drilled by Area



Fees charged for the various licences and services generated revenues of $636,800.

The program activities were undertaken by three permanent staff members in the Petroleum Development Branch as well as a portion of the director's time. Salary costs for the work unit were approximately $120,000. One hundred per cent was financed by the Revolving Fund.

For further information, contact Jerry Gossard, Director, Petroleum Development Branch, at 787-2593.

Crown Oil and Gas Rights

Disposition (Land Sales)

The province develops Crown oil and gas rights by selling use of those rights to industry. The disposition of Crown oil and gas rights to industry is in the form of permits, drilling reservations and leases. Specific lands requested by oil and gas companies are advertised in four sales held in each fiscal year. The successful bidders in the sale are awarded the rights which permit oil and gas companies to explore or produce oil and gas.

The Petroleum and Natural Gas Regulations, 1969 pursuant to *The Crown Minerals Act* provide the authority for disposition of Crown oil and gas rights by the sale process.

Goals for the fiscal year were to review all lands requested by companies, prepare sales notices and technical data for each sale, evaluate land parcels requested and award the rights to the successful bidders.

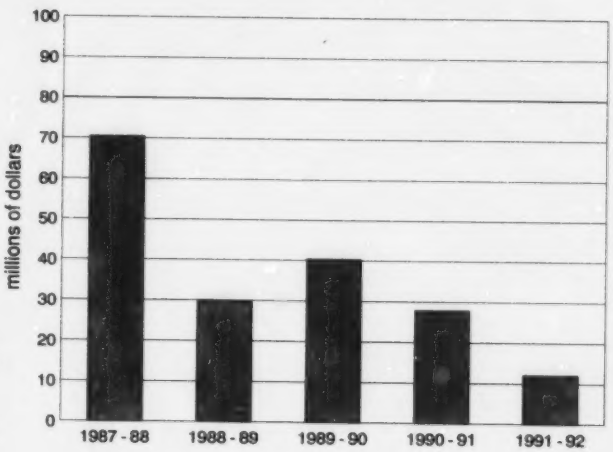
The four sales held in 1991-92 resulted in revenues of over $12 million. This compares to almost $28 million from the previous fiscal year. The decline reflects the general downturn in the oil industry.

Mineral rights disposed of during the fiscal year totalled 167,932 hectares. This consisted of 19 permits containing 48,057 hectares, three drilling reservations comprising 5,010 hectares and 726 lease parcels consisting of 114,865 hectares. Revenue derived from the sale of petroleum and natural gas rights for the past five years is shown in Figure 13.

The Geological Mapping and Land Evaluation Section of the Geology and Petroleum Lands Branch was responsible for this program. The program activities were undertaken by two geologists in the Land Evaluation Unit. They utilized geological maps prepared by two geologists in Geological Mapping Unit. Secretarial and clerical support were provided from within the branch. Salary costs for the work unit were approximately $280,000. Printing and other costs were about $20,000.

For further information, contact Gordon Hutch, Director, Geology and Petroleum Lands Branch, at 787-2606.

Figure 13 - Revenues Received From Sales of Crown Petroleum and Natural Gas Rights



Administration of Crown Oil and Gas Rights

Transfers, amalgamations, encumbrances and securities related to Crown dispositions are registered in a data base.

The data base is used to invoice lease rentals and to monitor offset commitments and compensatory royalty. The registry system and search service is utilized by the oil and gas industry, lawyers, financial institutions, and many others.

The Petroleum and Natural Gas Regulations, 1969 pursuant to *The Crown Minerals Act* set out the requirements for disposition administration and provide authority for the registry/search system.

Two goals for the fiscal year were to introduce a registry system to Saskatchewan similar to the systems in Alberta and Canada, and implement regulations for the administration of leases in designated heavy oil areas.

During the fiscal year, the new registry system was introduced. Also, all expiring petroleum and natural gas dispositions were reviewed to establish whether activity levels required by regulation were adequate. A total of 6,365 dispositions were reviewed in this fiscal year compared to 6,835 in the previous year.

Disposition transactions increased from 3,114 in 1990-91 to 3,935 in 1991-92. Searches decreased slightly from 3,600 in 1990-91 to 3,561 in 1991-92.

Work requirements of permits and drilling reservations were monitored and offset commitments were reviewed and enforced.

As indicated in the following table, at the end of the fiscal year, 4.1 million hectares of Crown minerals were under disposition compared to 5.2 million hectares at the end of 1990-91. This decline is to due to a general decline in interest in acquiring lands and dispositions expiring.

	As of March 31, 1992		As of March 31, 1991	
	Permits	Hectares	Permits	Hectares
Oil and Gas	153	1,037,594	191	1,620,050
Helium	0	0	11	322,817
Oil Shale	2	20,979	3	52,059
	Leases	Hectares	Leases	Hectares
Oil and Gas	11,188	3,021,290	11,551	3,168,168
Helium	11	22,584	11	25,619

Drilling reservations under disposition decreased in the same period from 11 to three, with a decrease in area from 19,541 hectares to 5,010 hectares.

A total of 10 gas storage agreements were in effect totalling an area of 39,171 hectares.

Fees for services generated $186,000 in revenue.

The Petroleum Lands Section carried out the duties related to this program with technical support from the Geological Mapping and Land Evaluation Section. Both sections belonged to the Geology and Petroleum Lands Branch. Cost of the program was approximately $250,000 for salaries and related expenses. There were seven staff in the section, including secretarial and clerical workers and an administrative officer. Additional technical support was provided by one geologist from the Geological Mapping and Land Evaluation Section.

For further information, contact Ron Pelletier, Disposition Administrator, at 787-2540.

Support Program

Oil and Gas Production and Disposition Data

This program involves the collection, processing, verification and maintenance of statistical data related to the production and disposition of crude oil, natural gas, water and associated products from all producing wells in the province.

The data base is used in the collection of royalties and taxes, forecasting, monitoring and the evaluation of Crown lands under disposition. It is also used to analyze and develop resource management policy and fiscal regimes and to establish, monitor and enforce oil and gas conservation and environmental and safety standards.

As well, the oil and gas industry relies extensively on the data base for production information to facilitate its exploration and development activities in the province. Data is also used by consulting firms, federal and provincial government agencies, universities and the general public.

The Oil and Gas Conservation Act and regulations require companies to submit the monthly statistical data to the department.

The basic goals of the program are to process and verify industry submitted data within 30 days, maintain the data collection computer system, and provide statistical information within 24 hours of request.

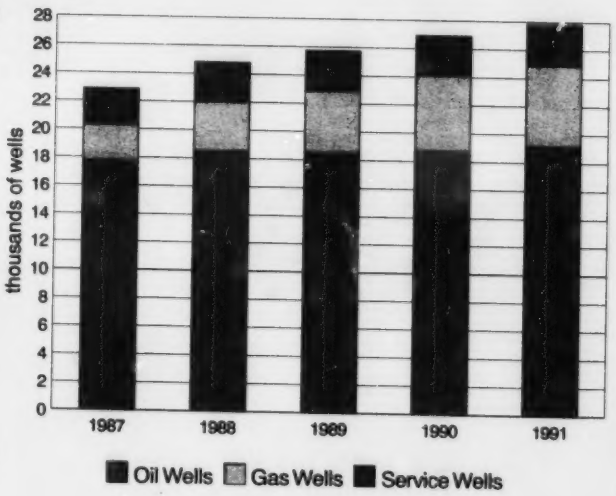
During the fiscal year, work continued on developing the data collection system. The changes were in response to the need to standardize reporting among Western producing provinces, simplify the reporting requirements and meet the information requirements under a deregulated market. The new system is flexible so that changing market conditions and new policy initiatives can be met.

All the work related to the development and testing of the new production and disposition system was successfully completed by June 30, 1991.

At the beginning of the fiscal year, normal processing of industry reported data was about three months behind schedule. This was mainly due to the implementation of new reporting forms, procedures and requirements. By early July 1991, every area of processing had returned to its normal schedule.

The number of wells capable of production by the end of 1991 was 27,851. The number of wells capable of production/operation by well type for the past five years is shown in Figure 14.

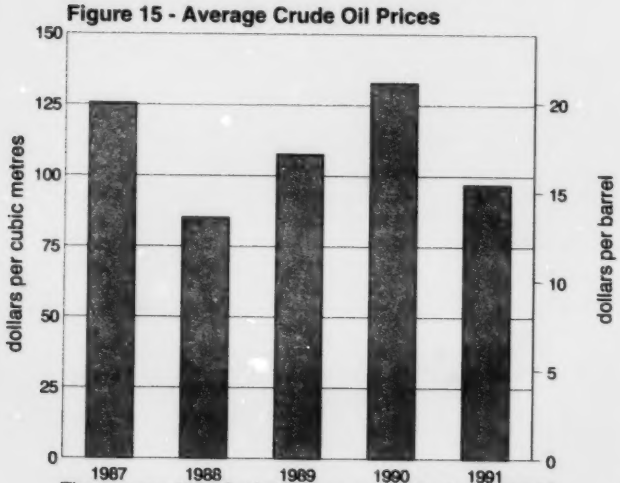
Figure 14 - Wells Capable of Production/Operation



Petroleum statistics are published in three periodic reports. The Weekly Drilling Activity Report provides information on both newly drilled and existing wells. The Monthly Oil and Gas Production Report provides production of oil, gas and water by unit and pool. The Mineral Statistics Yearbook provides production, disposition, value of disposition and provincial revenues from each mineral. Statistics are also provided in a variety of formats and on magnetic tape, microfiche, diskette or printout.

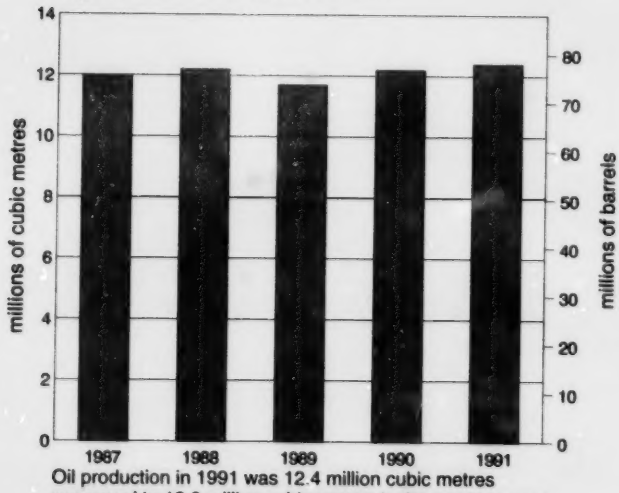
During the year, 816 copies of the Monthly Oil and Gas Production Reports, 768 copies of the Drilling Activity Reports and 176 copies of the Mineral Statistics Yearbook were distributed to industry subscribers and other users through the department's Marketing and Publications Branch. As well, 2,908 requests from industry for statistical information in a variety of formats were met on the basis of a one day turnaround. In 1991, revenue generated from the sale of reports and statistics totalled more than $57,500.

Figure 15 - Average Crude Oil Prices



The average 1991 Saskatchewan crude oil price of $97.08 per cubic metre represents a 27 per cent decrease over the $132.90 per cubic meter average for 1990. This decrease follows the trend in world oil prices over that time period.

Figure 16 - Crude Oil Production



Oil production in 1991 was 12.4 million cubic metres compared to 12.2 million cubic metres in the previous year. This slight increase was the result of drilling an increased number of higher productivity horizontal wells. On average, there was minimal shut-in of production due to marketing difficulties and pipeline capacity in 1991.

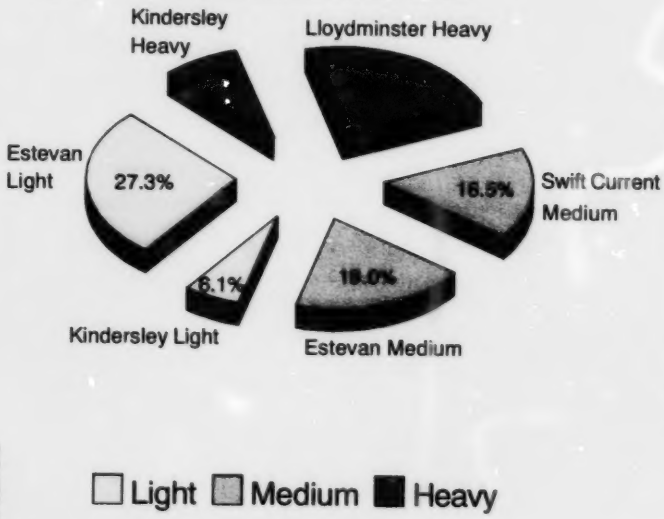
The program activities were undertaken by the Petroleum Statistics Branch. Total costs of the program were $682,200 including the salaries and related expenses for 19 permanent and two part-time staff members. Forty-eight per cent of the costs were covered by the Revolving Fund.

In addition, computer system costs for the production and disposition system were about $603,300.

For further information, contact Joe Dang, Director, Petroleum Statistics Branch, at 787-2607.

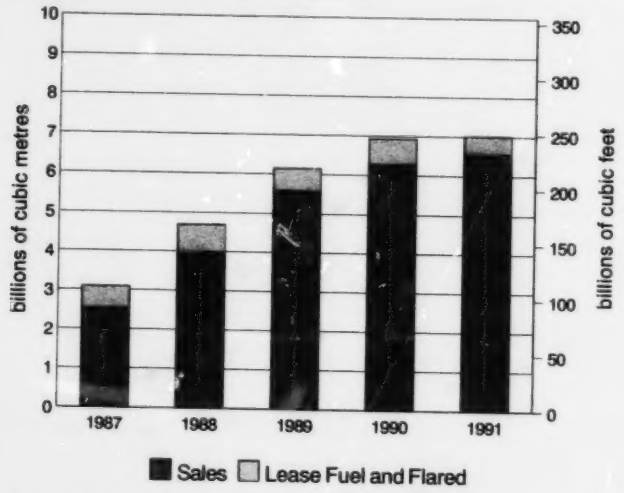
Figures 15-19 provide statistical information on oil and gas production and prices over the last five years and a breakdown of oil production by quality of crude.

Figure 17 - Quality of Saskatchewan Crude



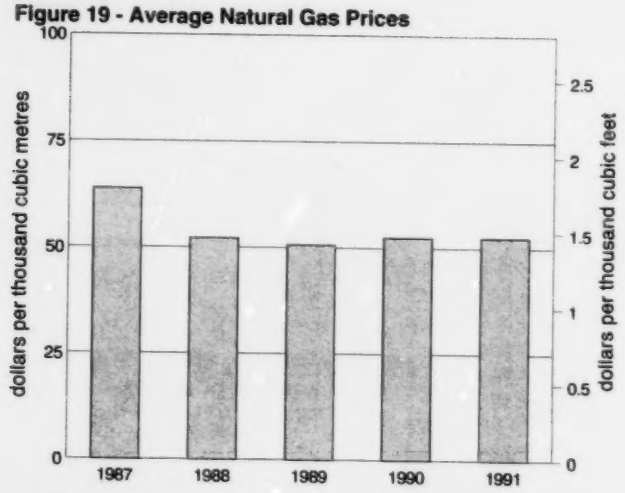
Saskatchewan's oil production is made up of different qualities of crude commonly identified as light, medium and heavy found in different geological zones and geographical areas. In 1991, approximately 31.1 per cent was heavy oil, 35.5 per cent was medium and 33.4 per cent was light.

Figure 18 - Natural Gas Production



Natural gas production in 1991 was 7.0 billion cubic metres, only a slight increase over the previous year. Sales of the province's natural gas were 6.6 billion cubic metres, and the remainder of the production used as lease fuel or flared. Approximately 3.7 billion cubic metres was exported from the province in 1991.

Figure 19 - Average Natural Gas Prices



The industrial recession and the natural gas supply/demand imbalance kept the average natural gas fieldgate price in Saskatchewan depressed. In 1991 the average fieldgate price was $52.49 per thousand cubic metres compared to $52.53 per thousand cubic metres in 1990.

Finance and Administration Division

Overview of Division

The Finance and Administration Division is responsible for mineral revenue collection and audits, maintaining records of mineral rights, internal administration and personnel, legislative co-ordination, computer systems services and marketing and publications.

The programs are carried out by four branches: Mineral Revenue Branch, System Services Branch, Personnel and Administration Branch and Marketing and Publications Branch.

The division is funded by the Consolidated Fund and the Revolving Fund.

Revenue Collection Program

Mineral Revenue

The mineral revenue program ensures that the revenues owing to the province are collected, administers mineral land ownership records and assures mineral compensation and trust expenditures are appropriate.

The acts and regulations administered by the program include:

- *The Crown Minerals Act* which prescribes royalties, rentals and fees payable by persons engaged in exploring, developing and producing minerals that are owned by the Crown;
- *The Freehold Oil and Gas Production Tax Act* which prescribes amounts payable by producers of oil and gas from wells drilled on freehold lands;
- *The Mineral Taxation Act, 1983* which prescribes base and profit-related payments due from potash producers, production taxes payable on freehold coal and mineral rights tax payable by taxable mineral owners; and
- *The Mineral Resources Act, 1985* which prescribes penalties to be applied to late payments.

Goals for the fiscal year were to:

- receive all revenues and reports within the time limits dictated by legislation;
- ensure that revenues received are correct and, if necessary, verified by audit;
- record and report revenue in accordance with established standards;
- assess appropriate penalties for non-compliance and ensure effective collection and follow-up action are taken on problem accounts;
- complete billings of resource revenues on time;
- establish audit schedules and conduct field audits in accordance with the annual work plan of the branch;
- accurately maintain and update, on a current basis, land ownership records for Crown and freehold mineral interests;
- verify ownership of mineral rights surrendered to the Crown; and
- ensure that all expenditures are legitimate and conform to the Financial Administration Manual guidelines.

During the fiscal year:

- All cash received was recorded and deposited on a daily basis, resulting in 11,568 cash disposition forms for the year.
- Revenues received were processed for preparation of monthly financial and management information reports.
- Clients were contacted on a continual basis to obtain delinquent reports, remittances and other information.
- Approximately 1,300 assessments of interest and penalties were issued on late payments and delinquent returns.
- Oil and gas royalty and tax variances, well levies, lease rentals, mineral rights tax, compensatory royalties, subscriptions and miscellaneous fees and charges were invoiced, generating over 8,000 invoices.
- 3,405 hours of field audits of resource companies were performed and desk reviews conducted to ensure appropriate revenues were received.
- Over 11,000 surrender, assignment and transfer documents pertaining to mineral rights were processed throughout the year to ensure integrity of the Crown and freehold mineral ownership records and the mineral rights tax data base.
- Investigations of 472 trust files to confirm ownership were completed.
- 877 expenditure vouchers were prepared, approved and processed on a daily basis.

Total revenue collected for 1991-92 was $331.3 million.

Details by resource sector are:

	1991/92	1991/92			1990/91		
	Actual	Budget	Variance	%	Actual	Variance	%
	millions	millions	millions		millions	millions	
Oil	$198.2	$217.2	$(19.0)	(8.8)	$283.0	$(84.8)	(30.0)
Natural Gas	42.8	53.9	(11.1)	(20.6)	49.6	(6.8)	(13.7)
Potash	50.8	57.5	(6.7)	(11.7)	49.9	.9	1.8
Uranium	14.5	17.5	(3.0)	(17.1)	19.3	(4.8)	(24.9)
Coal	15.8	14.4	1.4	9.7	12.3	3.5	28.5
Other Resources	3.2	2.5	.7	28.0	2.5	.7	28.0
Mineral Rights Tax	5.7	5.7	-	-	5.7	-	-
Other Misc. Revenue	.3	.4	(.1)	(25.0)	.4	(.1)	(25.0)
Total	$331.3	$369.1	$(37.8)	(10.2)	$422.7	$(91.4)	(21.6)

The revenues collected for the 1991-92 fiscal year were $37.8 million less than what was estimated because prices, sales volumes and land sales revenues were lower than forecasted.

Revenues collected in 1991-92 were $91.4 million less than the 1990-91 fiscal year because of falling prices, lower sales volumes and reduced land sales revenues.

Total revenue collected through assessment of late payment charges and penalties was $307,300, a decrease of $95,100 from the 1990-91 total of $402,400. Stricter enforcement of late payment penalties against oil and gas well operators in the Fall of 1991 resulted in 107 companies moving to Electronic Funds Transfer (EFT) to ensure their payments were received on time. Over 50 per cent of monthly oil and gas revenue is now being transmitted through EFT. With the combination of EFT and courier delivery by many larger clients, the revenue from delayed payment assessments should continue to decrease in future years.

Revenue generated from field and desk audits during 1991-92 was $1,823,800, compared to $4,774,700 last year. This year's performance has been hampered by delays in finalizing several potash and uranium audits. The potential recovery from this audit work-in-progress is over $2 million.

A program aimed at identifying ownership of mineral rights surrendered to the Crown totalled 986 files complete at year end. This program has now generated over $370,000 in bonus bid revenue since it began in May 1989.

Compensation payments to former mineral owners totalled $554,900 in 1991-92 compared to $662,700 in 1990-91. Payments to gross royalty trust certificate holders totalled $134,900 compared to $110,000 in 1990-91.

Other significant expenditure during 1991-92 included:

NewGrade natural gas royalty rebate	$ 1,428,800
Consumers' Co-operative Refineries royalty remission	$ 600,000

The mineral revenue program was administered within the Mineral Revenue Branch by four management, eight professional and 15 clerical staff at a cost of $1,265,800. In addition, approximately $360,000 in computer costs were incurred to maintain revenue, billing and tax systems.

For further information, contact Don Stirling, Director, Mineral Revenue Branch, at 787-2832.

Support Programs

System Services

The annual goals of system services are to provide planning, management, consultation and co-ordination for the department's information and computer systems. This involves acquiring and maintaining computer hardware and software, contracting for consulting and mainframe computer services, data security, data entry and word processing co-ordination.

The department operates 20 computer systems on a regular production basis. System analysis, development and maintenance functions are performed by department staff or co-ordinated with consulting services. Mainframe computer services are contracted to Information Systems Management Corporation (ISM).

The majority of the petroleum and natural gas related systems operate on the ISM mainframe computer facilities. Increasingly, the department is using micro computers for systems work.

The following major projects were undertaken in 1991-92:

- A new oil and gas production and disposition system was implemented.
- A potash performance model system was implemented.
- A number of systems were converted to calculate royalties for units on a well by well basis.
- Conversion from Wang word processing to Microsoft Word was completed which improved the department's administrative efficiency.
- A levy on wells and federal equalization information systems were developed and implemented in order to provide more detailed information on production by wells.
- A subscriptions list system was developed for the Publications and Marketing Branch, replacing their mainframe system at a reduced cost.
- A micro-based invoicing system was developed and implemented. All department generated invoices are now produced by this system and printed on in-house laser printers for improved efficiency.
- A micro-based forms input system was developed for the Operator's Monthly Return - Oil and Gas form. This will be distributed free-of-charge to the industry to assist them in reporting. The system also has the ability to convert the data into the format needed by the department for processing, eliminating the data-entry step. The department plans to expand this system to include the production and disposition forms.

System services were administered by a director, two full-time and one part-time computer analysts, one secretary and six data entry staff for a cost of $310,400. Mainframe services paid to ISM totalled $1,011,800. Expenditures for consultant services were $467,600 and $165,800 was spent on other computer items and general operations. Total expenditures for the year were $1,955,700. Forty-nine per cent of the expenditures were financed by the Revolving Fund.

Plans for the next fiscal year include reducing system costs by investigating alternative methods of delivery, changing some mainframe applications to micro-computers, upgrading the micro-computer network and

selecting a data base management system for use on in-house equipment.

For further information, contact Adeline Skwara, Director, System Services, at 787-2548.

Personnel Services

Personnel services, such as staffing, classification, employee ratings, staff development and training and benefits administration, are provided to the department by the Personnel and Administration Branch.

Goals for the fiscal year were to:

- attract, retain and develop a qualified and productive work force to discharge the department's mandate and core functions;
- promote a working environment in the department that emphasize teamwork, communication, positive employee relations and mutual respect; and
- retain and promote more women into the managerial ranks and attract more native and aboriginal employees.

During the fiscal year the following initiatives were pursued:

- In 1990, the department joined a number of government departments in the promotion of workplace wellness. In 1991-92, the department continued its commitment to this program, with the sponsorship of a number of contests such as "Walk the Stairs and Win" and "Walk Around Wascana In The Autumn".
- On June 13, 1991, the government announced its plans to transfer approximately 55 Petroleum and Natural Gas Division employees to Weyburn. One of the major activities for the branch in 1991 was employee counselling and the development of an action plan to oversee the smooth transition of operations.
- The department renewed its commitment to employment fairness, but was unable to achieve its targets because of the hiring restrictions.
- A directions and opportunities project was initiated in October, 1991 to identify the strategic directions and major opportunities for the department. Groups of employees were asked to explore opportunities to remove barriers, improve efficiency, increase revenues and improve assistance and service to industry. The department identified eight issues to address in the coming year, from information systems to a long-term integrated energy policy. As a spin off to the project, a systems task force was established to make recommendations regarding system costs and technology. A first draft of the recommendations was completed in March, 1992.

The personnel services function is provided by one director and one personnel assistant position.

The directions and opportunities project, employee wellness and employment fairness will continue to be priorities for the branch. Other initiatives to be pursued in the next year will be re-assessment of staff development and training needs, streamlining of existing personnel systems and a re-evaluation of services provided.

Administration and Financial Services

Administrative, financial and accounting services are provided to the department by the Personnel and Administration Branch.

The 1991-92 goals for the administration and financial services function were to:

- manage the prudent expenditure of the department's financial resources in order to meet program requirements and fiscal responsibilities; and
- ensure the procurement of adequate physical space and equipment for departmental staff to dispense their responsibilities.

In terms of financial services, the branch is responsible for budgets, expenditure control, financial reporting, processing funds from one division to another, federal-provincial claims administration and internal audit.

The branch manages central purchasing, inventory control, telephone installation and repair, office space and renovation co-ordination, mail services, office equipment repairs, requests for vehicles, building security and storage.

During the fiscal year, an Oil and Gas Revolving Fund was established. The fund is financed jointly through a graduated levy on each oil and gas well in the province and an operating subsidy from the department. This fund offsets the cost of regulating and providing services to the oil and gas industry.

Staffing for administrative and financial functions consisted of four permanent positions.

The combined cost for personnel, administrative and financial services was about $550,000. Approximately 80 per cent was spent on supplies, equipment, telephone rentals, etc. About 36 per cent of the salary costs were funded by the Revolving Fund.

For further information, contact Lynn Jacobson, Director, Personnel and Administration, at 787-2525.

Marketing and Publications

The marketing and publications program provides the production, promotion, sales and distribution of information on Saskatchewan resources on behalf of the department.

Information on technical and legislative issues promotes development and assists the industry in making investment decisions. General information promotes an awareness of Saskatchewan mineral and energy resources in schools and the community.

Sales of technical information totalled $225,400 in the past fiscal year. This amount includes $65,000 reported in the Geodata Branch and $12,030 in the Petroleum Statistics Branch. The most common general information package is a series of fact sheets

on Saskatchewan resources and a sample set of minerals common to the province. A total of 2,559 general information packages were distributed in 1991-92 compared to 2,854 in 1990-91.

Marketing and publications staff also maintained a resource library for use of staff and industry. In addition, staff co-ordinated the department book and journal orders, provided a daily newspaper clipping service for internal use and co-ordinated the production of a department newsletter.

Marketing and publications was administered by three staff for a cost of $98,400 in the Marketing and Publications Branch. Additional expenses to cover printing, duplicating, purchasing of print materials and operating costs totalled $208,300. Thirty-six per cent of expenditures were covered by the Revolving Fund.

For further information, contact Gail Smith, Publications and Marketing, at 787-3037.

1991-92 Budget, Actual Expenditures and Number of Persons Employed

DEPARTMENT SUBVOTES	Financial Report	Actual Expenditures	Person Years
Resource Policy and Economics	$1,427,000	$1,393,443	20.4
Geology and Mines	$1,836,000	$1,816,137	33.8
Petroleum and Natural Gas	$1,415,000	$1,385,870	32.0
Finance and Administration	$3,258,800	$3,247,882	46.6
Payments for Rent (SPMC)	$996,300	$839,257	–
Members of Executive Council	$36,600	$36,610	–
Revolving Fund Contribution	$2,509,100	$2,469,901	–
Trust Certificates	$130,000	$134,937	–
Mineral Development Agreement	$897,000	$896,635	–
Compensation	$560,000	$554,930	–
Interest on Refunds	$9,700	0	–
Fossil Fuel	$97,000	$94,759	–
Research Grants	$4,200	0	–
Total	$13,176,700	$12,870,361	132.8
OIL AND GAS REVOLVING FUND	$5,018,200	$4,939,802	74.2
TOTAL DEPARTMENT	$15,685,800	$15,340,262	207.0

Note:

To avoid double accounting, Revolving Fund contribution amounts are excluded from total department amounts.

Statistical Tables

Major Saskatchewan Industries - Statistical Summary

Crude Oil

Natural Gas

Potash

Uranium

Coal

Precious, Base and Other Metals

Other Minerals

Major Saskatchewan Industries- Statistical Summary

CRUDE OIL

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990 (est)	1991
Production (million bbls)	46.5	51.0	60.0	67.9	72.9	73.4	75.7	77.0	73.6	76.7	77.7
Value of Production ($millions)	$816	$1,295	$1,776	$2,176	$2,409	$1,154	$1,496	$1,027	$1,242	$1,604	$1,176
Direct Employment	3,520	3,740	4,690	5,820	7,100	4,340	4,780	4,760	4,160	4,580	4,310
Capital Spending ($millions)	$249.0	$244.0	$443.0	$739.0	$999.0	$224.0	$324.0	$361.0	$190.0	$284.0	$245.0
Wells Drilled	791	800	1,661	2,392	3,291	807	967	1,260	455	740	625
Revenues to Province:*											
Royalty/Tax - Net **($millions)	$249.9	$361.6	$451.1	$472.2	$473.4	$186.6	$260.8	$145.2	$196.3	$236.4	$168.0
Export Tax ($millions)	$164.0	$217.4	$44.2	$94.7	$35.3	–	–	–	–	–	–
Land Bonus Bids - Oil & Gas ($millions)	$ 43.8	$ 43.0	$123.7	$126.8	$122.7	$ 12.3	$ 70.4	$ 29.7	$ 40.4	$ 27.9	$ 12.0
Other***	$ 14.8	$ 20.5	$ 30.5	$ 24.7	$ 24.2	$ 14.0	$ 16.1	$ 13.0	$ 17.6	$ 18.7	$ 18.2
Total ($million)	$472.5	$642.5	$649.5	$718.4	$655.6	$212.9	$347.3	$187.9	$254.3	$283.0	$198.2

NATURAL GAS

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990 (est)	1991
Production (bcf)	44	44	43	58	69	81	91	145	200	231	238
Sales ($millions)	$20	$24	$50	$89	$120	$170	$167	$207	$294	$336	$373
Royalty/Tax* - Net** ($millions)	$0.7	$1.0	$4.6	$9.7	$13.3	$21.9	$22.2	$36.3	$34.6	$49.6	$42.8
Direct Employment	35	35	100	230	250	175	325	445	565	430	415
Capital Spending ($millions)	$2	$2	$22	$64	$71	$33	$92	$123	$164	$92	$78
Wells Drilled	16	9	154	441	484	244	594	795	1008	565	461

POTASH

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Production (000 K20 tonnes)	7,189	5,212	5,928	7,650	6,412	6,031	6,449	7,372	6,509	6,015	6,299
Sales ($ millions)	$995.1	$642.9	$685.9	$829.4	$621.5	$549.8	$670.7	$975.0	$880.0	$794.1	$769.1
Royalty/Tax* - Net** ($millions)	$185.0	$36.9	$39.7	$71.2	$32.6	$37.0	$48.7	$96.0	$31.3	$49.9	$50.8
Direct Employment	4,458	4,257	3,834	4,159	3,933	3,584	3,348	3,163	3,157	3,146	3,102
Capital Spending ($millions)	$267.3	$168.2	$112.2	$121.5	$94.4	$81.1	$34.6	$39.3	$48.5	$46.7	$42.6

URANIUM

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Production (million lbs)	7.5	7.7	6.1	15.3	15.4	17.9	21.4	21.3	19.3	15.0	17.9
Sales ($millions)	$258.3	$250.5	$121.4	$353.7	$456.4	$457.2	$637.5	$463.3	$380.2	$343.7	$303.8
Royalty/Tax* ($millions)	$29.9	$24.3	$11.1	$25.2	$36.3	$17.8	$19.7	$17.5	$15.5	$19.3	$14.5
Direct Employment	1,746	2,098	2,304	1,277	1,200	1,228	1,190	1,160	1,129	903	1053
Capital Spending ($millions)	$107.9	$253.7	$355.6	$156.4	$74.5	$61.4	$53.8	$52.5	$10.8	$28.1	$52.4

* 1991-92 fiscal year statistics.

** Crown royalty and freehold production tax less incentives and credits.

*** Miscellaneous revenue including lease rentals, interest and net royalty payments.

COAL

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Production (000 tonnes)	6,798	7,494	7,760	9,885	9,537	8,329	10,020	12,110	10,800	9,400	9,000
Sales ($millions)	$42.0	$62.5	$72.8	$98.0	$87.5	$82.9	$92.1	$110.3	$99.6	$93.9	$110.3
Royalty/Tax * ($millions)	$7.9	$11.0	$15.8	$17.4	$10.7	$13.6	$18.4	$14.9	$13.9	$12.3	$15.8
Direct Employment	380	416	431	543	530	463	557	673	600	518	500
Capital Spending ($millions)	$4.2	$40.2	$46.5	$3.6	$10.2	$6.3	$4.1	$44.1	$47.3	$7.0	$8.7

PRECIOUS, BASE AND OTHER METALS

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Gold											
Production (1000 tr.oz.)	10.2	7.4	4.2	5.3	6.8	1.0	29.6	36.4	87.0	108.9	99.2
Sales ($millions)	$5.6	$3.4	$2.2	$2.5	$2.9	$0.5	$17.6	$20.9	$45.0	$43.7	$33.4
Capital Spending ($millions)	0	0	0	0	0	$6.7	$12.8	$14.0	$11.0	$6.0	$22.5
Silver											
Production (1000 tr.oz)	174.2	130.7	153.6	219.9	162.1	81.4	43.0	48.4	26.2	8.0	6.1
Sales ($millions)	$2.2	$1.3	$2.1	$2.4	$1.4	$0.6	$0.4	$0.4	$0.2	$0.04	$0.03
Base and Other Metals											
Production (million kg)	11.6	11.2	11.7	14.5	9.8	5.9	3.4	4.6	2.2	0.5	0.7
Sales ($millions)	$18.3	$16.3	$18.3	$19.1	$15.8	$9.7	$5.5	$9.0	$4.1	$1.1	$1.3
Precious, Base and Other Metals											
Revenue* ($millions)	$N/A	$0.3	$0.2	$0.2	$0.5	$0.4	$0.8	$1.6	$0.8	$0.8	$1.5
Direct Employment	508	47	443	450	454	364	389	337	122	179	157

* 1991-92 fiscal year statistics.

OTHER MINERALS

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Sodium Sulphate											
Production (tonnes)	500,030	509,550	415,310	352,290	317,085	322,250	258,273	272,090	289,240	307,884	274,219
Sales ($millions)	$36.390	$43.640	$38.840	$34.230	$30.190	$29.720	$21.940	$22.439	$22.700	$23.735	$20.128
Royalty* ($millions)	$1.360	$1.700	$1.660	$1.390	$1.180	$1.220	$0.840	$0.868	$0.837	$0.868	$0.710
Direct Employment (minesite)	285	323	308	246	235	239	197	165	158	165	169
Salt											
Production (tonnes)	324,910	340,630	347,300	406,550	425,970	462,330	443,630	416,230	411,030	567,944	549,108
Sales ($millions)	$12.460	$14.160	$14.960	$17.350	$18.120	$20.300	$20.500	$20.240	$19.920	$20.203	$20.801
Royalty/tax* ($million)	$0.187	$0.212	$0.266	$0.286	$0.336	$0.288	$0.311	$0.194	$0.618	$0.588	$0.555
Direct Employment (minesite)	163	168	170	168	187	190	191	190	218	225	231
Sand and Gravel											
Production (million tonnes)	7.909	8.512	7.999	9.737	11.433	14.190	11.922	12.239	12.960	12.022	6.928
Sales ($millions)	$18.405	$21.001	$21.014	$22.070	$28.267	$31.509	$33.619	$33.043	$27.031	$23.462	$17.597
Bentonite											
Production (tonnes)	19,180	32,370	30,170	32,640	31,120	24,700	27,060	31,880	56,460	7,140	996
Sales ($millions)	$1.125	$1.955	$1.795	$2.035	$2.072	$1.604	$1.767	$2.326	$3.408	$0.370	$0.081
Clays											
Sales ($millions)	$3.964	$3.349	$3.571	$3.561	$3.812	$4.096	$3.866	$5.018	$7.370	$4.449	N/A
All Quarrible Materials (S & G, Bentonite, Clays)											
Royalty* ($million)	N/A	$0.073	$0.076	$0.098	$0.099	$0.108	$0.121	$0.219	$0.164	$0.160	$0.127

* 1991-92 fiscal year statistics.

Appendix - List of Publications

1991-92 Publications

Miscellaneous Reports

91-4 Macdonald, R., Sibbald, T.I.I., Harper, C.T., Paterson, D.F. and Guliov, P. eds. (1991): Summary of Investigations 1991, Saskatchewan Geological Survey; Sask. Energy and Mines, Misc. Rep. 91-4, 222p, (plus 22 maps).

92-5 Delaney, G.D. (1992): Gold in the Glennie Domain; Sask. Energy and Mines, Misc. Rep. 92-5, 71p.

92-6 Bennett, R.W. (1992): Assessment Work Catalogue, Saskatchewan; Sask. Energy and Mines, Misc. Rep. 92-6, 97p.

Miscellaneous Reports Reprinted

91-5 Staff (1991): Mineral Resources of Saskatchewan; Sask. Energy and Mines, Misc. Rep. 91-5, 76p.

Open Files

92-1 Kreis, L.K. and Gent, M.R. (1992): Sub-Duperow Formation Brines in Southern Saskatchewan; Sask. Energy and Mines, Open File Rep. 92-1, 77p.

92-2 Gent, M.R. (1992): Diamonds and Precious Gems of the Phanerozoic Basin of Saskatchewan: Preliminary Investigations; Sask. Energy and Mines, Misc. Rep. 92-2, 67p, (17 maps).

External Publications and Presentations

(Geology and Mines staff indicated in bold type)

Ashton, K.E., Hunt, P.A. and Froese, R. (1992): Age constraints on the evolution of the Flin Flon volcanic belt and Kisseynew gneiss belt, Saskatchewan and Manitoba, in Radiogenic Age and Isotope Studies: Report 5, Geological Survey of Canada, Paper 91-2, p55-70.

Ashton, K.E. and Leclair, A.D. (1991): Foliate: useful term to complement the textural classification of foliated metamorphic rocks: Reply; Canadian Journal of Earth Sciences, v28, p829-831.

Delaney, G.D. (1991): Gold in the Glennie Domain, Lower Proterozoic Trans-Hudson Orogen, northern Saskatchewan; Geological Society of CIM, First Annual Field Conference, Sept., Saskatoon, Program Abstracts, p11-12.

Delaney, G.D., Czornobay, B. and Earle, S. (1991): Utilization of image processed aeromagnetic and Landsat thematic image data for the improved understanding of the lithologic and structural characteristics of the Glennie Domain; Geological Society of CIM, First Annual Field Conference, Sept., Saskatoon, Program Abstracts, p11.

Froese, E. and **Ashton, K.E.** (1991): Alteration zones in the Kisseynew Gneisses of Saskatchewan and Manitoba: Geological Society of CIM, First Annual Field Conference, Sept., Saskatoon, Program Abstracts, p25-26.

Gent, M.R. (1991a): Diamonds in Saskatchewan; Alberta Geological Society and B.C. Energy, Mines and Petroleum Resources, 27th Forum on the Geology of Industrial Minerals, May, Banff, Program Abstracts.

Gent, M.R. (1991b): Diamond Exploration in Saskatchewan; CIM 93rd Annual General Meeting, May, Vancouver, Program Abstracts.

Gent, M.R. (1992a): Diamond Exploration in Saskatchewan; CIM Bulletin, v84, no.956, p64-71.

Gent, M.R. (1992b): Saskatchewan Diamonds: Opening a new mineral exploration frontier; Diamond Jubilee Convention, Prospectors and Developers Association of Canada, March, Toronto, Program Abstracts, pW-9.

Gracie, A.J. and Schwann, P.L. (1992): Northern Saskatchewan prime exploration area; The Northern Miner, v78, no4, pB7-8.

Harper, C.T. (1991): The Deception Lake lead-zinc discovery; A base metal-enriched iron formation; Geological Society of CIM, First Annual Field Conference, Sept., Saskatoon, Program Abstracts, p10.

Kreis, L.K. (1991): Depositional history of the Jurassic System and hydrocarbon accumulations in the Wapella-Moosomin area, southeastern Saskatchewan; in Christopher, J.C. and Haidl, F.M. (eds.), Sixth International Williston Basin Symposium, Sask. Geological Society, Special Publication No.11, p165-178.

Kreis, L.K., Gent, M.R. and Vigrass, L.W. (1991): Subsurface brines in southern Saskatchewan; in Christopher, J.C. and Haidl, F.M. (eds.), Sixth International Williston Basin Symposium, Sask. Geological Society, Special Publication No.11, p283-292.

O'Hanley, D.S., Kyser, T.K., Rees, M.I. and **Sibbald, T.I.I.** (1991): The age of the auriferous granites and mesothermal gold mineralization, Goldfields area, Saskatchewan; GAC/MAC Joint Annual Meeting, May, Toronto, Program Abstracts, v16, pA92.

Sibbald, T.I.I., O'Hanley, D.S., Kyser, T.K., Rees, M.I., Appleyard, E.C. and Roberts, R.G. (1991): Geology of the gold deposits, Goldfields, Saskatchewan; Geological Society of CIM, First Annual Field Conference, Sept,

Saskatoon, Program Abstracts, p14-15.

Thomas, D.J. and **Harper, C.T.** (1991): Gold in northern Saskatchewan: Alternative metallogenic models; Geological Society of CIM, First Annual Field Conference, Sept., Saskatoon, Program Abstracts, p20-21.

Thomas, D.J., Reilly, B. and Watters, B.R. (1991): Tectonostratigraphic controls on massive sulphide deposits in the Amisk Group: Flin Flon-Amisk Lake area; Geological Society of CIM, First Annual Field Conference, Sept., Saskatoon, Program Abstracts, p26.

For further information,
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